

TABLE I
Vessel Movements in Foreign Commerce
(Net registered tonnage)

	Year	ENTERED		CLEARED		TOTAL	
		Vessels	Tonnage	Vessels	Tonnage	Vessels	Tonnage
Boston, Mass.	1849	3,973	576,708	3,806	524,254	7,779	1,100,962
	1876	1,891	637,738	1,776	577,515	3,667	1,215,253
	1926	1,546	3,782,419	1,027	2,510,766	2,573	6,293,185
New York	1849	10,249	2,335,379	9,699	2,143,157	19,948	4,478,536
	1876	5,514	4,467,139	5,136	4,282,377	10,650	8,749,516
	1926	4,982	20,575,120	4,948	20,427,157	9,930	41,002,277
Philadelphia, Pa.	1849	606	142,000	539	7,120,327	1,145	7,262,327
	1876	1,385	844,294	1,334	826,954	2,719	1,670,348
	1926	1,311	3,134,087	990	2,554,480	2,300	5,488,567
Baltimore, Md.	1849	484	110,068	634	149,928	1,118	259,996
	1876	1,077	667,857	1,112	685,626	2,189	1,353,483
	1926	1,449	1,912,802	1,364	1,767,245	2,813	4,680,047
Norfolk, Va.	1849	140	29,570	319	69,758	465	99,328
	1876	30	17,391	108	61,450	138	79,381
	1926	1,566	4,354,941	2,472	6,899,852	4,038	11,254,793
Charleston, S. C.	1849	298	98,406	438	147,139	736	245,545
	1876	268	113,170	290	126,874	558	240,044
	1926	179	551,269	211	523,847	390	1,075,116
Savannah, Ga.	1849	127	64,154	173	84,863	300	149,017
	1876	316	209,589	263	169,181	579	378,770
	1926	164	272,932	262	511,535	426	784,467
Mobile, Ala.	1849	156	87,071	256	148,116	412	235,187
	1876	149	87,752	172	98,475	321	186,226
	1926	387	613,681	545	671,371	932	1,285,052
New Orleans, La.	1849	1,098	425,499	1,181	487,690	2,279	913,139
	1876	797	599,582	830	635,373	1,627	1,234,955
	1926	2,215	5,421,529	1,994	4,842,938	4,209	10,264,467
San Francisco, Calif.	1849	none	none	none	none	none	none
	1876	532	621,382	545	665,649	1,086	1,287,031
	1926	525	1,759,525	636	2,124,801	1,161	3,884,326
Los Angeles, Calif.	1847	none	none	none	none	none	none
	1876	none	none	none	none	none	none
	1926	2,084	3,626,055	2,029	3,464,333	4,113	7,090,388

The city has developed a railroad belt line insuring rail connection from all present or future railroads entering the port to all wharves. These wharves under the city bureau of wharves, docks and ferries are of the best double pier type and are a monument to the city and its faith in the port. Statistics show the same phenomena as for other ports; that the tonnage and value of commerce has grown rapidly while the number of ships is sometimes even less.

Port of Baltimore

BALTIMORE is another historical port. G. H. Pauder, general manager of the export and import bureau of the Baltimore association of commerce tells of the remarkable development of this old American port.

Commercial shipping at Baltimore goes back more than 200 years. Shipping interests determined the location of the city and the port has always been an active factor in the development of American overseas and coast-wise trade. A new era of shipping activity began for Baltimore after 1870 and since then the port has been an important factor in water borne traffic.

In 1927 Baltimore was the second port in the United States in foreign trade measured in cargo tonnage. Railroad freight differentials on export

and import traffic moving from and to the Middle West have given Baltimore lower freight rates than those in effect in Philadelphia, New York

and Boston. These differentials also applying to intercoastal traffic have been instrumental in making Baltimore during the past four years the first port of the Atlantic seaboard in shipments to the Pacific coast, and the second port during 1926 to 1927 in total intercoastal commerce. During the last three years Baltimore has led all Atlantic coast ports except New York in commerce with outlying possessions of the United States.

In 1877 a channel depth of about 25 feet had been attained, and the main channel width was approximately 300 feet. At the present time the main channel has a depth of 35 feet at mean low water and a width of 600 feet. Application has been made to the government for a deeper and wider channel.

Fifty years ago port terminal facilities of Baltimore were to be found only in the inner section of the harbor known as the Northwest branch. Terminal facilities now include 35 covered and open overseas piers with a total space of 3,670,277 square feet and with a berthing space of 90,549 lineal feet. Accommodation at the overseas merchandise piers is provided for the simultaneous loading of 62 vessels. The city owns 10 piers in the upper harbor with a total area of 1,263,047 square feet. Large groups of specialized waterfront industries operate their own wharves and warehouses as plant accessories.

(Continued on Page 116)

TABLE II
Value of Exports and Imports
(By Customs Districts)

	Year	EXPORTS	IMPORTS	TOTAL
Boston, Mass.	1849	\$10,264,862	\$24,745,917	\$35,010,779
	1876	37,256,136	37,413,623	74,669,759
	1926	41,283,000	305,879,000	347,162,000
New York, N. Y.	1849	45,963,100	92,567,369	138,530,469
	1876	308,574,223	311,712,910	620,287,133
	1926	1,662,538,000	2,224,964,000	3,887,502,000
Philadelphia, Pa.	1849	5,343,421	10,645,500	15,388,921
	1876	40,291,794	22,471,516	62,763,310
	1926	97,055,000	195,823,000	292,828,000
Baltimore, Md.	1849	8,000,660	4,976,731	12,977,391
	1876	31,393,570	22,340,629	53,734,199
	1926	129,348,000	105,241,000	235,589,000
Norfolk, Va.	1849	3,373,738	241,935	3,615,673
	1876	7,053,841	21,415	7,075,256
	1926	209,520,000	21,599,000	231,119,000
Charleston, S. C.	1849	9,701,176	1,475,695	11,176,871
	1876	18,088,152	455,562	18,543,714
	1926	55,485,000	12,007,000	67,492,000
Mobile, Ala.	1849	12,823,725	10,050,697	22,874,422
	1876	15,157,655	1,611,765	16,769,420
	1926	42,157,000	9,717,000	51,874,000
Savannah, Ga.	1849	6,857,806	371,024	7,228,830
	1876	22,682,312	512,691	23,195,003
	1926	104,549,000	19,490,000	124,039,000
New Orleans, La.	1849	37,611,667	10,050,697	47,662,364
	1876	84,231,665	11,602,803	95,834,468
	1926	413,793,000	238,805,000	652,598,000
San Francisco, Calif.	1849	none	none	none
	1876	31,781,008	34,866,481	66,647,489
	1926	186,773,000	210,139,000	396,912,000

Glimpses From the Gangway

American Sea Traditions Are Deep Rooted—Her
Former Maritime Pre-eminence Must Be Regained

By Captain Geo. S. Laing

THE artist who painted the cover of this anniversary number of *MARINE REVIEW* began his splendid picture with canvas, and the writer of this article must do likewise, as canvas driven craft were still scouring the Seven Seas in 1878. True the square-rigged vessel had already been challenged, but she was by no means vanquished until the dawn of the present century.

Every phase of national progress, every forge ahead in economic development, every click of advance in commerce and industry, was put in motion through the activity of sailing ships and sailormen. This bold statement will not even quiver when one looks into the retrospect of exploration, colonization, and legitimate trading abroad, as distinguished from crude barter.

Pacific ports such as San Francisco and Portland, Ore., grew rich, and became commercial centers, because they were associated with canvas driven craft. The ports of New York and Boston drew their adolescent strength from the marvelous feats in voyaging which were common in those days. Yet, how little do we appreciate the pioneering which was done in maritime affairs in the United States. Are we not too apt to follow the academic view, and lay all the laurels in distant Tyre and Carthage, where the Phoenicians developed sea sense and sagacity?

Let us remember the American shipbuilders who felled the trees of the forest in the states of Maine and Washington, and built ships, that for swiftness, were objects of pride to ourselves, and of envy to other maritime powers. Those fairy-footed argosies were only outrivaled by the advent of iron construction. Think also of the captains and mates who thrashed those white-winged beauties around the Cape of Good Hope and the Horn. Try to realize what American seafarers were up against in the days when vessels, cargoes, and lives, depended on the skillful manipulation of ropes and sails. Wire-

less signalling was unknown, coastal life saving stations were few, uncharted dangers frequently proved their location by seizing a vessel in their cruel fangs.

Even to begin to understand the evolutionary steps which this writing touches on, the reader must be reminded of a progressive principle, which could be termed the root of marine logic. It can be expressed thus: Broadly speaking, industry means manufacturing things, agriculture means growing things, but sea commerce means the sale and world wide distribution of those commodities. Exporting and importing are the arteries and veins of a nation



or country. It is the traffic which ebbs and flows in those channels that makes, and measures, much of the wealth of the United States.

It is no digression to go a little further into sea economics, and mix with bankers, for they are wise in international dealings, and can gage the purse of the average man, as well as feel the fluctuations of our friend the merchant. If a statistical officer in Washington, D. C., wished to sound the nation's welfare he could get accurate information based on telegrams from, say, Galveston, Philadelphia, and Tacoma. Who would supply the necessary data? A banker and harbor master in each port. While the gentleman of finance knows how the currency of his country stands in relation to buying, selling, building and trading, the dock official is conversant with the export and import transactions of the interior as well as the coastal territories. After all, the situation is sized up

pretty well by glancing at the hatches and gangways of merchant ships.

The steps in the story of marine progression are so numerous that we must bring out another canvas driven craft, and pay her a tribute. In one respect the fore-and-aft schooner is unique, in that she became active at a very early stage in American history, and has never been ousted from her coastal enterprise.

During the life of *MARINE REVIEW*, schooners have been challenged by towage, auxiliary craft, and steamships in general, and yet, they can be seen today, entering Gulf ports, wing and wing fashion, before the breeze, or slipping under Cape Cod well reefed to rest their pinions from the onslaught of an adverse Atlantic gale. Of course their numbers have been reduced by steam and motor driven craft, but, unlike the square-rigger, the schooner has not been annihilated. While the fore-and-aft vessel lacks the symmetrical beauty of her square-rigged cousin, she is on the right side of the ledger when carrying capacity and earnings are being totalled.

Before railroads had thrown their steel ribbons so profusely across the United States, the fore-and-aft schooner had established a network of trade routes from the Arctic circle to the Equatorial belt. Occasionally, as if to show her sporting characteristics, she has been known to put the land below the horizon and enter transoceanic highways. In such venturesome voyaging she may masquerade as a barquentine by stepping a three-spar foremast, and carrying square canvas thereon. Rigged in this fashion she behaves better when running before a gale, and becomes more handsome. Nevertheless, the real fore-and-aft schooner, American built, and manned, stands before the marine world as a marvel of utility.

Only one other trading power—Russia—has attempted to specialize in schooner traffic, but as Russian coastal outlets are scattered all over Europe and Asia, the chance for development is impossible. Russia, as far as sea commerce is concerned is an object lesson in faulty geographical setting. From Archangel

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to Vladivostok, by water, is almost an explorer's task, whilst Petrograd to Odessa, puts coastal ideas out of the question. The writer has mentioned this to bring out the point that nature has blessed the United States with an admirable coastline, where, for thousands of miles, schooners can ply their trade unmolested, within their own territorial waters.

Another salt water craft rolled and pitched on the restless sea, but finally dived into oblivion, during the anniversary era between 1878 and 1928. Sailors, with perhaps a little disparagement in their tone, called her the half-breed; she heralded the side-wheel and the propeller, and drew the first smoke trail across the Banks of Newfoundland. The artist with profound inspiration depicts this type of vessel in the background of the cover. With subtle strokes of the brush he creates an atmosphere of daring by showing us a barque-rigged steamer running under single topsails, and lower fore-and-aft canvas, in a boisterous wind and sea.

This is just as it should be, for it took intrepid builders to put money and brains into ships that were on trial; while captains were equally skeptical of the steam boilers, piston tail rods and glistening crank shafts. Some of the half-breeds were made of wood, others had iron hulls of boilerplate dimensions. In both cases they were unwieldy craft, as their weighty structures and engine and bunker space robbed them of carrying capacity.

Low pressure boilers, compound engines, and high coal consumption were only a few of the obstacles which kept the half-breeds from attaining immediate glory. Nevertheless these auxiliary craft must be looked upon as the pioneers of mechanical propulsion. Much of the experimental work which has made the present day liner what she is, was involved in the lamp lighted engine room of a half-breed. Owing to low skylights, those engine rooms were frequently knee deep with green seas, while the coal in the bunkers was glowing through spontaneous combustion brought about by imperfect ventilation. Of course the tribulations of the side wheeler were even greater, and the North Atlantic navigators and engineers of today wonder how such craft could roll along in a beam sea with flour-mill machinery dangling across their waists. It took steel construction, which meant lighter hulls and more cargo, triple expansion engines, increased boiler pressure, and a semi-converted personnel, to dismantle the half-breed until she was

entirely a propeller driven ship. Many windjammer salts refused to go in steamers of any kind.

Then out of the mists of evolution came the horde of cargo steamers called tramps. This humiliating name simply means they are not tied to

Why a Merchant Marine?

By Capt. Geo. S. Laing

AT THIS very moment the United States are in a quandary concerning maritime affairs, and those in authority have a complex problem to solve. Yet, there never was a better chance to keep the American flag on the Seven Seas. It is there now, in Valparaiso and Vladivostok, in Calcutta and Callao, in Sydney and Singapore, and so on.

The American nation cannot afford to weaken its international trading prestige. If they hand over the reins of sea transportation to carrier nations, they automatically break a fundamental principle, which is, that self controlled sea commerce is essential to national safety and industrial security.

There was a time when it was actually good business for the United States to hire German, Norwegian, and British ships as carriers, but that adolescent stage has passed.

American industry and influence have gone far beyond the three mile limit in the last decade, and for that reason alone, a stability in sea power must be maintained under the American ensign.

As with the carrying and personnel, so it is with the building. American shipyards cannot rust because a vessel can be turned out cheaper in Britain or Italy.

any particular trade or route. Tramps and cargo liners are really the backbone of the commercial world, for they outnumber all other types of craft, and are wholly concerned with the carriage of merchandise. Where the American box-cars take the salute in railroad review, the tramp steamers take it in floating tonnage. Indeed each vehicle is the complement of the other, and it would take a Riley to separate them in print, while nothing short of international wars can put a kink in, or embarrass their practical movements. Manila in the Philippines,

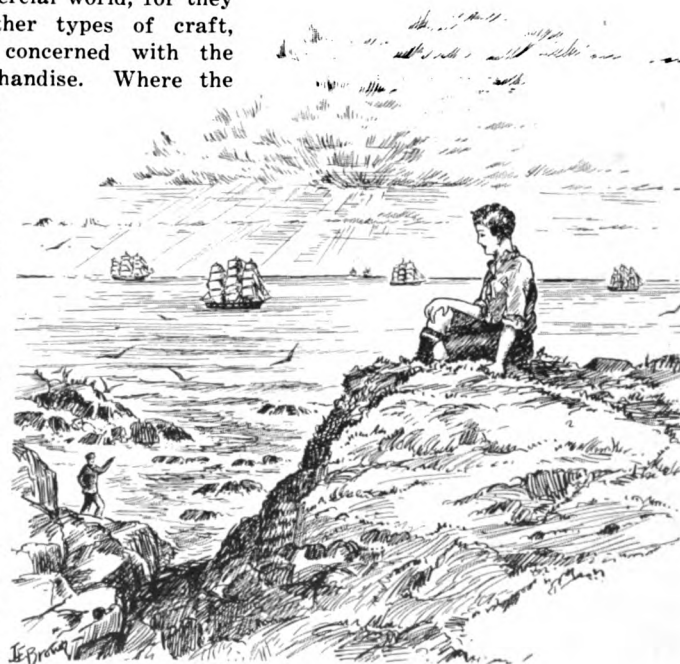
to Mobile in Alabama; New York, to Port Natal in Africa, it's all the same to a tramp.

The society belle of the ocean is the mail and passenger liner. She appears in her 24-knot glory on the front cover, and although the majority of craft must waddle in her wake, as an institution, she is democratic to a point of chivalry in the service of the people. In price per mile, as in food and lodging, this greyhound packet of the deep, beats the railroad and shore hotel off the map. True, she humiliates some of her guests by laying them low while she tussles with an angry sea, but a little inconvenience whets the appreciation, and adds to the enjoyment of the calm days which eventually follow.

As a power plant the giant liner ranks with full grown battleships, with her spacious accommodation makes her resemble an ocean caravan, which can transport four or five thousand travelers from one continent to another. The palatine grandeur of a mail boat's interior almost justifies the printing of the gaudy classics so dear to ticket agents.

In glancing at merchant shipping affairs of the past half century, one finds it an insurmountable task to condense into a short article one quarter of the items of interest and improvement which pass in panoramic array across the mind. In fact the achievements of Great Lakes craft and personnel alone would overload a medium sized book.

No "movie" picture of commercial activity in the world could eclipse a film taken from Port Huron docks.



Getting Sea Fever

At this lake and river junction one may view a marine panorama that is more than astounding. It is informative. Many of the craft in themselves are unique, in that their architectural lines differ entirely from the salt water fleet. Whereas many ocean tramps are full grown at three hundred feet, the Great Lakes freighter may have a keel plate over six hundred feet in length. Some of these floating elevators can carry nearly half a million bushels of grain, or thirteen thousand short tons of coal or iron ore.

See Skillful Lake Navigation

To navigate such long, but shallow cargo hogs through narrow waterways, place them tenderly alongside piers, nurse them through snow blizzards on Lake Superior, wriggle them across canal sills, and snub them in locks, would appear to be the work of a juggler. In reality, it is the accomplishment of skilled master pilots, who rise to be captains by beginning at the right end, deck hand, and in some cases coal passer. It is only fair to pay such custodians of lives and property a salary which makes them the highest paid skippers of cargo vessels afloat.

We are still on the dock at Port Huron or Detroit. Welland canallers, most of them built to the limit in length—two hundred and sixty feet—are steaming up to Duluth with pulp wood from Quebec, or package freight from Ogdensburg. Others are bound seaward with transshipment grain for Montreal. Tugs and tow barges shriek their steering signals to oil tankers, and three-deck passenger craft.

Where is the center-board schooner, the craft that started all this inland water trade? Alas, she is rotting in the mud of the creeks. Water witches haunt her cabins, snapping turtles play around her forefoot. The men who knew her as a yacht of commerce are interested in little farms on the shores of Lake Michigan, or Erie, or looking over great harbors such as Cleveland, or Buffalo, from an office window. But we cannot dwell too long on retrospect. What about the present, and the future of American maritime affairs?

Millions of people in the British Isles, where sea commerce is paramount, never understood the economic ramifications of merchant ship traffic until they had to tighten their belts during the Great War. And in the light of analogy millions in the United States are in the same boat. Until the 'teen age scholars are taught marine

geography; the relation of export and import commerce to national prosperity; the interdependence of the war and merchant ship; in short, that a huge continental country like theirs *must* think with an international mind, the values accruing from marine activities will remain hidden. Is it not on the sale and purchase, plus the movement of goods, that the whole mercantile fabric depends? The people in the Dakotas depend on ships, although they might dispute it for a few minutes. Railroads stop very suddenly when they come to the great terminals at tide-water, or lake ports.

Great Lakes, and tidewater coasting traffic, are not troublesome to the United States, as such zones are territorial in nature. Hence the federal laws govern the operation, and control the navigational activities of ships in these trades. But in ocean traffic the game becomes an international one, and several economic factors must be overcome, before American ships can strike a balance in the office. The main troubles come out of the fact that United States shipyards cannot build vessels at a cheap rate, and that American crews are—when compared with foreign crews—paid, housed, and fed, in a fashion which is the envy of those who serve under other flags.

If three tramp steamers, American, British, and Norwegian respectively, visited the same ports on a year's voyaging, carried the same tonnage, and received the same freight rates, their operating expenses would show no resemblance, the breach between the high figure of the United States craft, and the low figure of the Norwegian vessel would astound us.

✕ Should Train Our Youth ✕

The best advertisers of American goods in foreign markets are American ships and sailors, and a subsidized bolster seems to be the saving grace of the situation. In the matter of personnel, juvenile training will answer the call. All maritime powers are grappling with efforts whereby the young will adapt themselves to life afloat. The lost romance of the windjammer has taken boy thought away from the sea, but the life is now safer, more comfortable, and remunerative, than hundreds of jobs on shore.

Attach a nautical department to the evening classes which are now in vogue. Make the first year's study an optional affair. It will act as a mind culture, and be the means of disseminating the sea spirit. Then offer those hardy lads who enroll for

a second term of evening instruction, a chance to go afloat after their eighteenth birthday. The writer was third officer of a thousand ton barque at that age, but times have changed for the better. All branches of the merchant marine would invite boys who had passed through the second term of instruction. Thus the ocean tramp, the salt water coaster (steam, sail and auxiliary), the fishing fleet, Great Lakes craft, and inshore service bays, would each find new blood. The liners could draw on lads who had at least one year's experience in the harder branches, as kid glove training spoils a youth.

Heed American Interests

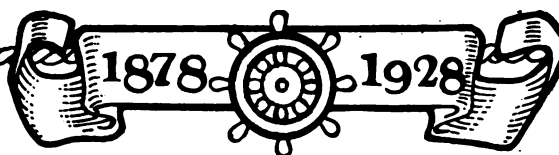
The Atlantic and Pacific passenger and mail boats flying the stars and stripes are favorites with many discriminating patrons who prefer to use American ships, simply because the service is unimpeachable.

Let this same spirit enter into the cargo ship business, for the ocean going tramp steamer, the coastwise schooner, and the craft of the inland waters are the Great Moguls of national and international trade. Is there a country under the sun that has risen to greatness without sea affiliations?

To these fragmentary glimpses of the marine world, much could be added. Some of the old craft have been resurrected for a moment, while the present day ships have scarcely been mentioned. Let us dip the ensign to craft such as the cable ship, the intermediate vessel that carries both cargo and passengers, the Gloucester fishing schooner, the whaler, the tug family, oil tanker, and cold storage craft, and so on. All are working twenty-four hours a day to further American interests.

Geographically, the United States lies in a very favored position for the development and maintenance of sea trading. With two sea coasts, an inland lake system, and the Panama canal, there is not much land left in that circle. It is a gigantic affair—this marine business, and its progression.

In the mechanical department there is no such thing as rest. The present day turbines with small but fast propellers, the adjuncts to reciprocating machinery, light and heavy oil fuels and engines, and a whole gamut of hissing contrivances are coming and going to the great joy of the patternmaker. But the writer belongs to the bridge. Let the man with a piece of waste in his paw tell his own story.



Marine Review - Fiftieth Anniversary - July 1928

I An Editorial I

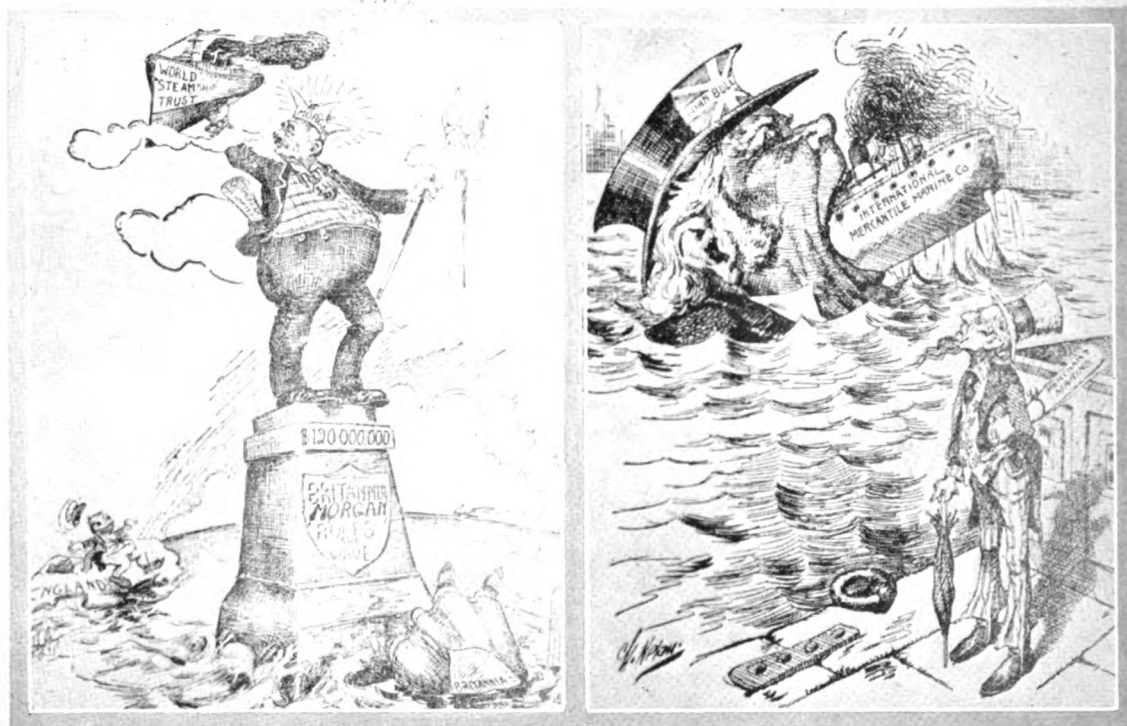
IT MAY be true that there is no patriotism in business and that just as water will find its level, trade will ebb and flow according to economic laws and that the ocean carriage of such trade will go to those who are able to give the best service at lowest cost. This is the argument advanced time and again to show the futility of trying to build up an American merchant marine.

BEST service at lowest cost! Let that be the open sesame to a real American merchant marine. Who is there to say that it cannot be accomplished with our resources in mechanical genius and wealth? Is there a defeatist's propaganda in our own camp aiding the foreigner in inculcating the idea that it cannot be done? Has the ultimate end in mechanical and human efficiency been reached by the present great mistress of the sea and her satellites? Judging by all the standards of our industrial progress we think not.

LET us analyze for a moment the apparent advantages of our competitors. The materials from which ships are built cost them more; due to a lower standard of living, their labor costs less (and how can they depend on an indefinite acquiescence to this condition). At the time, in trained personnel, they hold the advantage; but who will say that their raw material in manhood is superior? Fuel to drive their ships, not even excepting coal, costs as much and in most instances more. And then it is said their laws are less exacting, imposing a lighter burden than in our case. A careful study will show the major part of such difference as does exist is again due to our higher standards for the common man.

NO—THE main trouble with prospects for an American merchant marine has been the lack of an immediate incentive for attracting American brains, energy and capital to the solution of the problem. We have not been stirred into that heat of action which alone can spell success for any enterprise, and that is where the recently enacted Jones-White merchant marine law is a godsend to those who believe in and are working for an adequate merchant marine flying the American flag.

AND now let us serve notice to the world that the United States is on the seas to stay, not in a belligerent mood but with a spirit of willing to live and let live; with the clear understanding that we intend to make no apologies to anyone for a serious attempt to carry a reasonable share of that trade to which we are a party.



Left—Entitled "Britannia Dethroned" and Captioned "American Ability Casts Down Another Idol"—Philadelphia Press, Oct. 3, 1902. Right—Captioned, "He's Swallowed It, Be Gosh!"—New York Globe, March 12, 1904

A Panorama of Marine Events

Moves in Review 1891--1914

Quaint and Absorbing Tales of Launchings—Combines—Heroism—
Rate Wars—Speed Records—Engineering Developments

By B. K. Price

IN FOUR musty but heavily insured scrap books owned by the International Mercantile Marine Co. is to be found one of the most thrilling chapters in the history of shipping. Beginning late in 1891, when modern transoceanic travel was fast taking form, these yellow volumes carry a record of innumerable events both large and small for a period of more than 23 years.

Launchings, combines, disasters, heroism, rate wars, speed records, engineering developments, ship subsidy, personals and a multiplicity of other subjects all pass in kaleidoscopic review; and while dealing largely with north transatlantic trade, the scope of these volumes fairly sweeps the seven seas. Clearly it was the work of one vitally interested in all manner and forms of marine shipping, and all things related to it,

and regardless of particular locality.

In the compilation of these books, no attempt was made at subject classification—that, in fact, would have been short of impossible. Rather events were registered as they occurred, the gay mingling with the sad, achievement with disappointment and the trivial with the important.

A thrilling narrative of the ST. PAUL and LUCANIA racing into port through 10 hours of fog to settle a question of speed supremacy may have for its neighbor a story of entirely different cast; such for instance, as one concerning the unfortunate recipient of a plate of hot soup down the back of his neck and who in consequence, it appeared, made the welkin ring.

The appearance of such ships as ST. PAUL, ST. LOUIS, LUCANIA, NEW YORK, KAISER WILHELM DER GROSSE, PENNLAND and others brought with

them a new era, and comparison of that period with the one preceding was the object of an early clipping from the *Philadelphia Bulletin* in 1897. This newspaper reviewed briefly the strides in ocean travel over the preceding 50 years, and went back to the time when the BRITANNIA, 1350 tons, was the crack transatlantic liner of the day. The speedy ST. PAUL and ST. LOUIS had reduced the time in crossing the Atlantic to one-third, it was pointed out.

Mention was made of the GREAT BRITAIN of the 50's and 60's and, incidentally, of the strange disappearance in mid-ocean of her genial and courtly Captain Gray, who upon entering his stateroom one night was never seen again.

The mammoth GREAT EASTERN, with her five funnels, double paddle wheels, screw, and 600-foot overall

length, was described as an incubus from the day she left the stocks.

"Little children of 30 years ago," the *Bulletin* said, "were taught about two wonderful ships—NOAH'S ARC and GREAT EASTERN. The one held all the animals in the world and the other was considered big enough to hold them. Instead of being the pride of the sea, for which she was intended, she was a white elephant; too big for everything, excepting to hold the coal necessary to run her. Whenever her owners saw her, they groaned in agony of spirit, but she lived to lose them many fortunes."

The ceremony in New York in 1893, which attended the admission of the PARIS and NEW YORK to American registry, was described as one of the most dramatic and important events of the maritime history of the United States.

"The president of the United States and his cabinet were present to honor the thrilling ceremony, and as the flag of the Union was slowly un-

furled to the breeze, the guns of the United States cruiser, CHICAGO, anchored nearby, thundered forth the grand salute from this mighty nation, which was joined in by the big guns of Castle William and the Brooklyn navy yard.

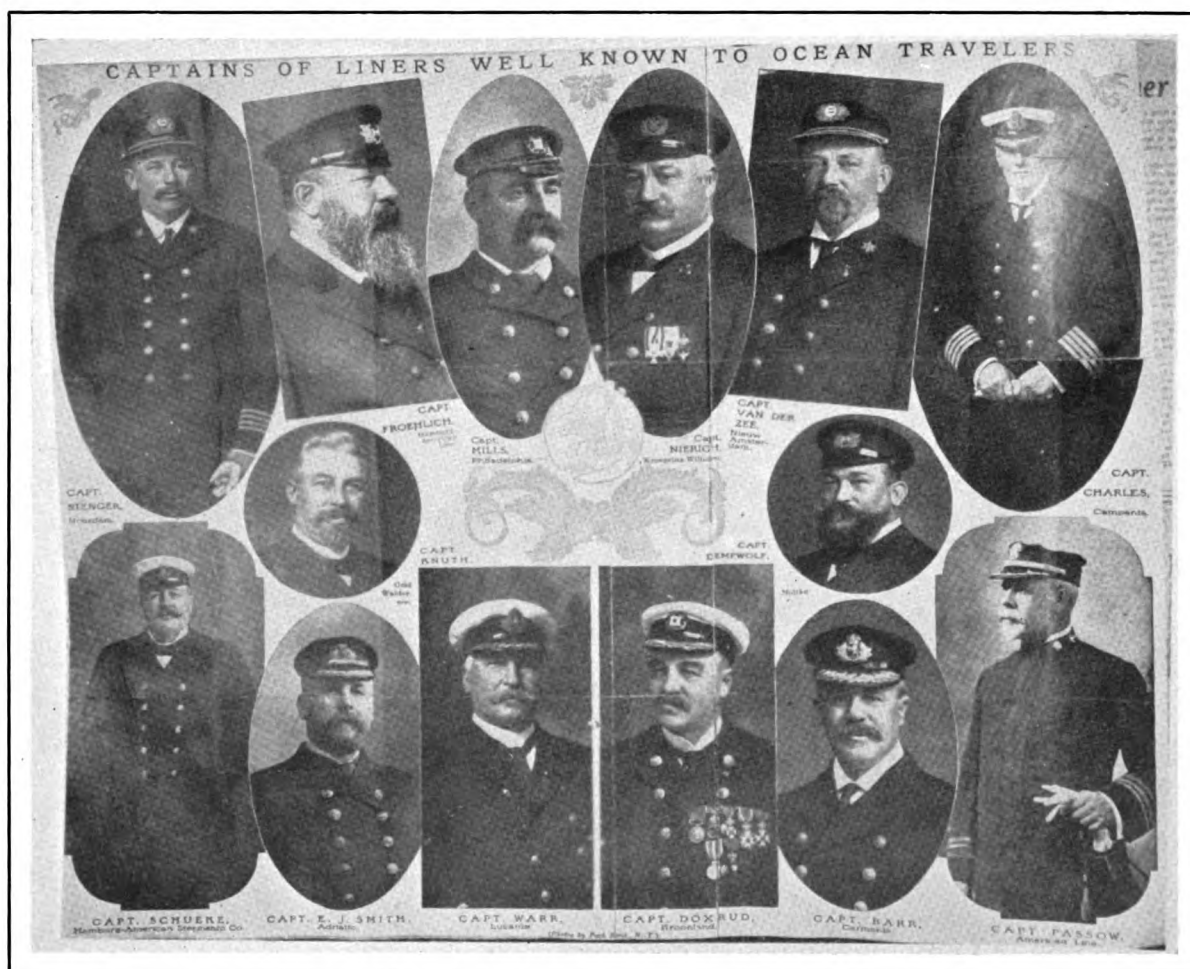
"In order to carry this project through," the *Bulletin* continued, "a special act of congress had to be passed and Clement A. Griscom, president of the International Navigation Co., had to agree to build two steamships (ST. LOUIS and ST. PAUL) of tonnage and speed equal to that of the NEW YORK and PARIS."

The question of ship subsidy raged with particular and unabated fury throughout many of the years covered by these volumes. Such names as Senator Mark Hanna, noted president maker; Senator William P. Frye, chairman of the commerce committee; and Clement A. Griscom were prominently mentioned among the strong advocates of ship subsidy. Senator Frye was the author of the first subsidy bill introduced by Mark

Hanna in 1899. Mr. Griscom, in a sense, was spokesman for the shipping and business interests.

In an article, appearing in the *Saturday Evening Post* in 1901, he outlined his position thus: "We are asking in the matter of American ocean mails," he said, "for substantially the system which Great Britain has followed almost since the beginning of steam navigation and for which, during 60 years, she has spent in the neighborhood of \$240,000,000. In a word, the object of the shipping bill is to complete the industrial independence of the United States."

Later in that year, the *Philadelphia North American*, in a scathing editorial, denounced the so-called Frye subsidy bill as something the passage of which would establish a vicious precedent. "If the ship subsidy hunters succeed next winter in filling their bags, every hungry lobbyist in and out of congress will feel that he has been given a special license to imitate their example. Once



Capt. Stenger, Noordam; Capt. Froelich, Hamburg American; Capt. Mills, Philadelphia; Capt. Nierich, Kronprinz Wilhelm; Capt. Van Der Zee, Nieuw Amsterdam; Capt. Charles, Campania; Capt. Knuth, Graf Waldersee; Capt. Dempwolf, Moltke; Capt. Schueke, Hamburg American; Capt. E. J. Smith, Adriatic; Capt. Warr, Lucania; Capt. Doxrud, Kroonland; Capt. Barr, Carmania; Capt. Passow, American Line.—New York Times, Nov. 8, 1908.

poaching on the treasury is permitted, it is a hard matter to draw the line between who shall and who shall not have access to the public funds."

Later upon the failure of a Hanna sponsored shipping bill to pass, this newspaper carried the accompanying cartoon, entitled "Sad Accident to Our Infant Industry."

One of the most eloquent appeals for ship subsidy, on the other hand, and one quoted at length to this day, was made by Elihu Root, secretary of state under President Roosevelt, in Kansas City in 1906. Pointing out that American ships were laboring under the disadvantages of high wages and high standards of living in this country and to action of foreign nations in paying subsidies to their ships, he said these disadvantages were created by governmental action and should be neutralized by governmental action. He believed subsidy was the fair and sensible thing.

"We cannot repeal the protective tariff; no political party dreams of

repealing it; we do not wish to lower the standard of American living or American wages. We should give back to the shipowner what we take away from him for the purpose of maintaining that standard," Secretary Root concluded.

Early in this century newspapers were filled with rumors and denials concerning the organization by J. Pierpont Morgan of a shipping combine which would be the largest ever attempted. On Oct. 1, 1902, the formation of the International Mercantile Marine Co., with Clement A. Griscom president, was definitely announced. A giant organization, with a capital of \$120,000,000, it combined six lines, the American, Red Star, White Star, Atlantic Transport, Dominion and Leyland, and brought under one head a fleet of 140 ships, with a gross tonnage of 1,100,000 tons. Following the announcement, the *Philadelphia Press* carried a cartoon, reproduced, entitled, "Britannia Dethroned."

The organization, as analyzed by the *Philadelphia Press*, included all

but three or four of the transatlantic steamship lines of sufficient magnitude to be known by name to the general public. Out of 18 ships of 20 knots and over in the north Atlantic trade, no fewer than seven, three British and four American belonged to the International Mercantile Marine Co.

Then, later, in 1904, Mr. Griscom became chairman of the board and J. Bruce Ismay, president and active head. This development caused no little speculation and comment. The *New York Herald* at the time said:

"To those who recall the exultation in this country when the Inman line hauled down the British flag and hoisted the American and the subsequent acclaim which greeted the formation of Mr. Morgan's big ship combine—the nucleus of a fleet which was to make the American merchant flag dominant on the ocean—this return of Mr. Ismay as the English head of this combine will seem a bit satirical. It will also recall to American investors that recent observation of Bernard & Bacon, of the Atlantic Transport line—"The English shipping men have their own property again, plus the cash contributed by their syndicate, plus the property of the American lines."

Similar sentiment was expressed in a cartoon appearing in the *New York Globe*, March 12, 1904, and reproduced on page 36 with its caption, "He Swallowed It, Be Gosh!"

Britain's Supremacy Restored

Among the many clippings compiled in these volumes are some strange and interesting yarns, none stranger than "the serious tale of a slumbering whale." The American liner, *PHILADELPHIA*, on her way from Southampton to New York, encountered the tired mammal, and the *Philadelphia North American*, June 19, 1905, relates some of the details thus:

"A careless whale, one summer day, asleep upon the ocean lay, thinking of naught it was so hot, that even his enemies he forgot. He slumbered sound, in the sun he basked, and never a question of danger asked. He was so big and so strongly made, he saw no reason to be afraid. So he slumbered on, in joy serene, like a huge black island upon the sheen."

Then, so it appeared, the *PHILADELPHIA* arrived on the scene, and the lookout, one Hansen, became highly excited, and yelled to Captain Roberts, but too late for the boat plowed on and "like a scimitar she clove that whale in twain, and its two parts went off afloat across the glassy main."

**PROGRAMME OF
GRAND CONCERT**

To be Held in the First-Class Saloon
On Board the U.S.M.S. "St. Louis."
(CAPTAIN J. C. JAMISON.)
On SUNDAY EVENING, DECEMBER 31st, 1905.
For the Benefit of J. P. MORGAN.

PART I.

"Watch on the Rhine" St. S. M. HEXTER
"Gaily King"
The Celebrated German Comedian **BARON VON ROSENSTEIN**
"La Maitresse"
The Light Weight Whirl **WM. ROSENBLUM**
"The Complete Proving" Mr. J. S. THOMSON
J. ROSENBLUM and H. BROWN
"The English Humourist" Mr. J. LEWIS
J. ROSENBLUM

PART II.

"Une Nuit Chez Maximus"
Words and Music by Judge Mayer
Costumes by A. C. Heilmann
Sonic Effects by Samstag and Hilder Ede.
Floral Display by Max Weisman

Un Son Vivant **H. ROSENFELD**
Un Poyon **J. ROSENBLUM**
Un Garden **W. ROSENBLUM**

TABLEAUX A BED OF ROSES.

QUADRILLE-CHAOT.

Ph. WEISS
J. WERNER
L. C. CHAIN
J. WILDER
Mrs. A. CHURCH

A Happy New Year to All.

Printed and Published on Board.

Then there are stories of unintended voyages, including one about a leading steamship official, who following a jolly midnight supper, went down to the pier to inspect some unloading machinery, only to forget all about the purpose of his visit once he arrived. Climbing aboard in his evening clothes and recognized by the purser, he insisted that all he wanted was sleep and lots of it. The ship's officer was confident that the big man of the line had no idea of going abroad, but was unable to get him into a state of more than half consciousness.

The *New York Times*, relating the incident in some detail, said, "he was a huge man who weighed more than 300 pounds and when he slept he slumbered all over. He had an astonishing big head when he finally came to, long after the steamship had passed Sandy Hook, and wanted to know who had shanghaied him."

Many others went abroad against their wishes and intentions. Often they were tricked into it by their own friends and relatives who desired to get them away from business for a rest. Usually these affairs ended happily, also, for once the victims became reconciled to the fact that the affairs of their respective companies would probably go on just the same—at least for awhile—they set about to enjoy themselves.

Then there were those who had every intention of going abroad but tried to keep their plans a secret from steamship officials. These, of course, were the well-known stowaways. Perhaps the most wholesale movement of this kind recorded in the four volumes occurred in 1909 when the *CEDRIC*, enroute to New York from the Mediterranean, discovered 28 stowaways. The weather, it seems, got rough and stowaways began to turn up in unexpected places in all parts of the vessel. Christmas day brought a special dinner in the steerage as well as in the cabin; also the yuletide spirit of forgiveness. So the unwelcome passengers were invited to participate in the feast, which all those in any condition at all did with gusto and much abandon, it is recorded.

In September, 1904 New York City greeted the arrival of the new 20,718-ton transpacific liner *MINNESOTA*, the largest ship built in this country up to that time. Constructed at New London, Conn., she was on her way around the Horn for service between Seattle and Yokahama. She was said to be only exceeded in size by three other steamships in the world, the *CEDRIC*, *BALTIC*, and *CELTIC*.



From the *Philadelphia North American*, Feb. 25, 1903

The development of wireless telegraphy may be traced by various clippings relating mostly to new records. The first shipboard wireless was installed on *St. Louis* in November, 1899, and while progress for considerable time was slow, it was sure. In 1902, the *PHILADELPHIA* announced the record reception of 150 miles.

Radio, however, never came in for greater acclaim than it did seven years later upon the occasion of the sinking of the *REPUBLIC*, off Nantucket late in January, 1909. Wireless was given the principal credit for the saving of many hundreds of lives, and the story of Jack Binns, the operator, constituted one of the brightest spots in the annals of all marine history.

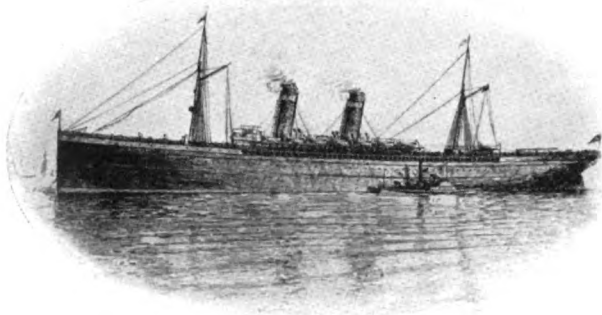
The *New York Times*, Jan. 26, 1909, carried in part the following: "Three sides of the wireless room had been carried away when the *REPUBLIC* was rammed by the *FLORIDA*, but there sat Binns, exposed to the weather, his

hands so stiff from cold that it was with difficulty that he could hold the key of his instrument. . . . The ship was filling fast. Batteries were needed, and Binns, realizing that all hopes of bringing help lay in his messages, went to a storage room where he had to dive into a water filled compartment and swim and wade around until he found them."

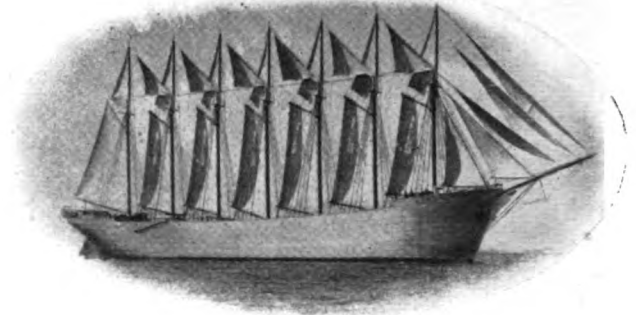
All day and far into the night, so the account continues, Binns remained at his key before he remembered that he was working in clothes soaking wet and that he was badly in need of nourishment.

Many are the other deeds of heroism recorded in these volumes. There is Capt. George C. Apfeld, of the sinking *WAESLAND*, who sacrificed his life's savings of \$10,000, badly needed for an invalid wife, rather than leave his bridge for a single second. There is the first assistant engineer, John Anderson, of the *St. Paul*, who with his life in his hands, worked

(Continued on Page 108)



Transatlantic passenger steamer St. Louis—1895



Seven-mast schooner Thomas W. Lawson—1902

Shipbuilding Science Makes Rapid Strides During Past Fifty Years

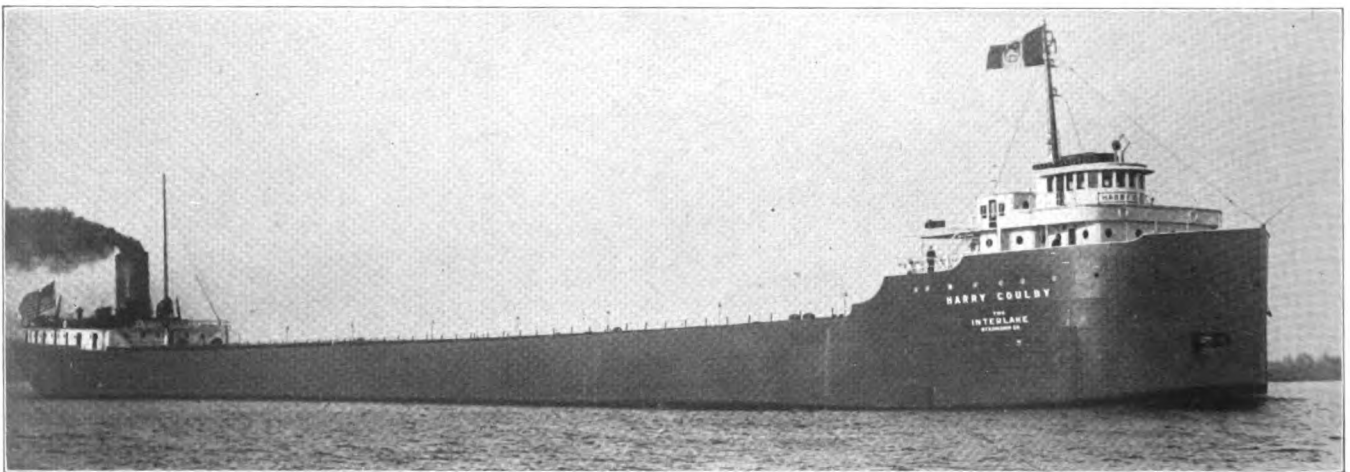
By Fred B. Jacobs

STUDENTS of maritime history often refer to the shipbuilding activities of a half century ago as belonging to the renaissance period. Strictly speaking, however, American shipbuilding never has undergone a revival. On the other hand it has progressed uninterruptedly practically ever since the forebears of New World civilization settled on the eastern seaboard. To be sure, the art has enjoyed seasons of high prosperity and low depression during the nearly three and a quarter centuries since it was established in the American colonies, but no marked revival has ever taken place. Progress has been steady along well-defined lines so that today certain American bottoms are among the finest and most able craft afloat, embodying as they do perfection in design and workmanship.

Before taking up the activities of 50 years ago, it may be well to refer briefly to even earlier efforts which played their part in laying the foundation for our present-day progress. It is a matter of record that the first ship built in the new world was laid down at Popham beach by the mouth of the Kennebec river in Maine, 1607.

The Massachusetts colonists built their first vessel at Medford. She was launched on July 4, 1631 and christened by Governor Winthrop, to whom she belonged, *THE BLESSING OF THE BAY*. The unsettled condition of things in England at that time, caused by her civil wars, reflected on the Massachusetts colony. Industry had not yet become remunerative and the settlers depended on England largely for supplies. However, shipbuilding held its own and the little industry

thus started grew rapidly and prospered wonderfully for that time. For example, who at this day and age would believe that shipbuilding in a small way had been carried on uninterruptedly in one spot for nearly two centuries. Such is the history of the yards formerly in operation at Hanover, Mass., where shipbuilding was carried on continuously from 1660 to 1835. In these yards, which were confined to the building of comparatively small craft from 150 to 400 tons burden, generation after generation of families worked, the trade being handed down from father to son. It is needless to state that this procedure developed a high degree of skill. Iron work for these vessels was made at Bardins Iron works on Indian Head river, the supply of raw material being bog ore which was found in abundance in the near-



Harry Coulby—Largest present-day Great Lakes ore carrier with a gross tonnage of 10,179

by ponds. These works were in operation until as late as 1853 when 16 men were employed to make from 200 to 250 tons of anchors annually, the largest of which weighed 5000 pounds. These early vessels were fastened with wood trenails generally, although copper began to be used at a later period. The supply of raw material was mined in Maine and smelted on Point Shirley in Boston harbor.

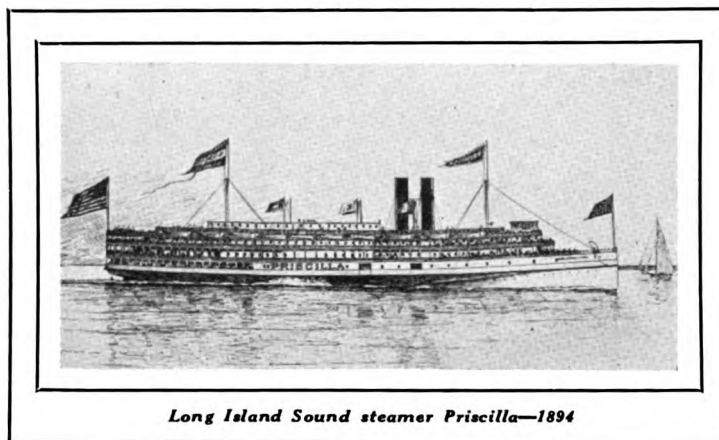
Shipping Showed a Healthy Growth

It was such yards as the foregoing, which were scattered along the New England shores, which gave the United States an early supremacy of the seas. Indeed, between 1830 and 1836 the American merchant marine increased 12¼ per cent a year, while the British increased only 1½ per cent. And American ships were beginning to achieve fame as fast sailers. Comes now a man who deserves undying fame, John Willis Griffiths, designer of the *RAINBOW*, the first true American clipper ship. This vessel registered 750 tons and was built at the Smith & Damon yards, New York, in 1845. She revolutionized ship design. She had a sharp entrance with a double curve on the water line which ran with easy lines to the midship section where the greatest beam was located. From the midship section the underbody tapered aft with lines almost as fine as those forward. Griffiths discarded the codfish design and gave his ship a dead rise amidships. She created a sensation by making a run from China to New York in 88 days, an unheard of feat for that time.

Thus began the famous clipper ship days of which so much has been written. Griffiths designed another crack ship the *SEA WITCH*. Launched in 1846 she was the largest vessel afloat. She carried more canvas than a ship of the line of twice her tonnage and her famous passage from China to New York in 77 days has never been beaten by a sailing vessel. The gold rush of 1849 was an incentive for American shipbuilders to turn out fast ships as passages to the Pacific coast were at a premium. During that time Donald McKay of East Boston, probably the most famous shipbuilder the world has ever known, turned out the *FLYING CLOUD*. This vessel made a record that stands today. She sailed from San Francisco

to New York in 89 days. On July 31, 1851 according to her log book she ran 374 miles in 24 hours. Her average speed for the 24 hours was 15 6/17 knots. Nearly a quarter of a century passed before an ocean steamer attained a speed of 15 knots.

Another famous McKay vessel was the *SOVEREIGN OF THE SEAS*. On a voyage from Honolulu to New York in 1853 she logged 15½ knots for four consecutive days. During one day she averaged a speed of 17½ knots for 24 hours. She made the passage from Honolulu to New York in 82 days. Later she crossed the Atlantic from Newfoundland to the Irish coast in 5 days and 17 hours, distinguishing herself by outsailing the *CANADA*, a Cunard liner. In passing it may be well to state that



Long Island Sound steamer *Priscilla*—1894

these records hung up by American ships never have been equalled by vessels of other nations. In the year 1800 the tonnage of American sailing vessels afloat was 972,492. This increased gradually until the figure equalled 4,662,609 in 1861. While sailing vessel days were on the decline it was not until 1893 that steam tonnage predominated over sailing vessels. The figures for that year give the tonnage of steam vessels as 2,183,248; and sailing vessels, 2,118,197.

Early American Steam Vessels

While sailing vessels always will be used to a limited extent in certain lines of coastwise trade, steam vessels are far more economical. Though the fame of the United States merchant marine of other days was built up chiefly by its incomparable sailing vessels, steady and satisfactory progress in the design and construction of steam vessels has been going on since 1807 when the *CLERMONT*, the world's first successful steamboat, was launched. She was built under the supervision of her designer, Robert Fulton. Her hull was wood,

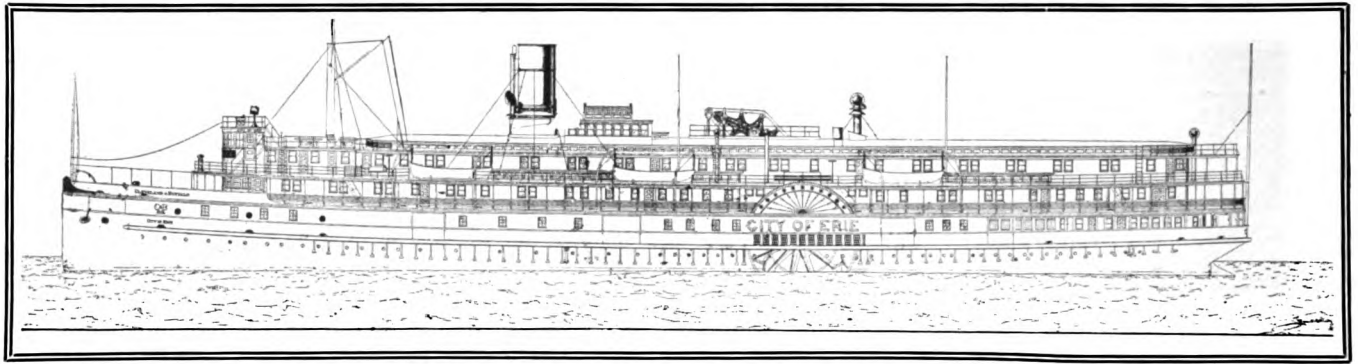
constructed by Charles Brown. She was 133 feet long, 18 feet beam with a depth of hold of 7 feet. Her engines were furnished by Boulton and Watt of England. The single cylinder was 24 inches in diameter with a 4-foot stroke, while her boiler was copper, 20 feet long, 7 feet high, and 8 feet wide. Her paddle wheels were 15 feet in diameter with eight buckets to each wheel. The buckets were 4 feet long and dipped 2 feet.

Early War Vessel Was Unique

Mention also should be made of the United States war vessel *DEMOLOGOS*. Here American ingenuity is shown in constructing the initial war steamer. This craft was designed by Robert Fulton and built in New York in 1814. Her hull was wood, constructed by Adam and Noah Brown. She was 156 feet long, 56 feet beam, with a depth of hold of 20 feet. Her engine was 48 inches bore and 5-foot stroke, while her boiler was copper, 22 feet long, 8 feet high, and 12 feet wide. Her hull contained a well in the center for her one paddle wheel, which was 16 feet in diameter, 14 feet wide, dipping 4 feet. This well was 66 feet long with the boiler and engine located on opposite sides.

Her wooden sides were 5 feet thick above the water line and she mounted 16 guns. It is to be regretted that this relic of other days was not preserved as a perpetual museum. She demonstrated her efficiency as a steam war vessel, although no opportunity offered for her to take part in an actual engagement. On June 4, 1829, she blew up accidentally, killing 25 of her crew.

One of the finest transpacific ships of a half century ago was the *CITY OF PEKING*, which was designed by Edward Faron and built in 1874 by John Roach & Son, Chester, Pa. This vessel was iron, 419 feet over all, 47 feet 4 inches beam, 19 feet 6 inches depth of hold, while her loaded draft was 22 feet. She was powered with two vertical inverted compound engines; the two cylinders of each engine being 51 and 88 inches in diameter while the stroke was 54 inches. Her indicated horsepower was 4000. Her engines turned 52 revolutions per minute under steam pressure of 60 pounds to the square inch. She was a single-screw vessel both engines working on one shaft. Her propeller



The City of Erie is representative of a Great Lakes passenger vessel of 30 years ago

was 20 feet 4 inches in diameter, 30 foot pitch. Her gross tonnage was 5079.

A notable Great Lakes passenger vessel of that period was the STATE OF OHIO built in 1880 by the Detroit Dry Dock Co., Wyandotte, Mich., which firm later was absorbed by the American Shipbuilding Co., Cleveland. This vessel had an iron hull 225 feet long, 32 feet beam, with a depth of 12 feet. She was powered with a vertical beam engine built by Dunham & Co., New York, in 1847. This engine had a cylinder bore of 50 inches with an 11-foot stroke. The normal horsepower was 1800.

An interesting Great Lakes freight vessel of that time was the ONOKO, built by the Globe Iron Works, Cleveland, now the American Shipbuilding Co. This remarkable vessel was the prototype of the present-day bulk freighter. The ONOKO was an iron vessel 302½ feet over all, 39 feet beam 25-foot depth of hold with a carrying capacity of 3000 tons at a 14-foot draft. She was powered with a fore-and-aft compound engine capable of developing 900 horsepower. Built to carry ore from the upper lake ports, she proved very economical in operation when compared with the lake schooners in use at that period.

One of the finest Mississippi river packets of 50 years ago was the JOHN W. CANNON. She was designed

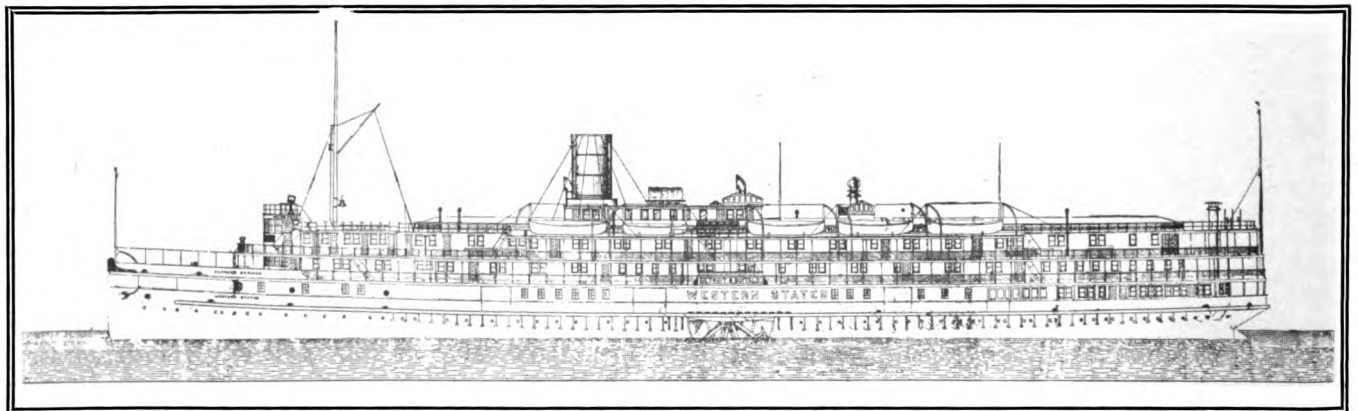
by Edward J. Howard and built in 1878 at Jeffersonville, Ind., by Howard & Co. for the Coast & Mississippi River Packet Co. at a cost of \$250,000. Her hull was wood. She was 252½ feet long on the keel, 43 feet beam, and drew 6 feet of water. Her engines were high pressure horizontal, one cranked to each paddle wheel shaft, and were built by Ainslie & Cochrane, Louisville, Ky. The cylinders were 34 inches in diameter with a 9-foot stroke. Her wheels were 38 feet in diameter with 16-foot buckets.

Charles H. Cramp in the spirit of meeting the free-ship people half way, agreed to a compromise which provided that ships of British registry might be admitted to American registry, if their owners would build two ships of equal class and tonnage in the United States. This was the act that led to the two English steamers NEW YORK and PARIS of the International Navigation Co., an American corporation owned by American capital, being brought under the American flag. Then the ST. LOUIS and ST. PAUL were built by the William Cramp & Sons Ship & Engine Building Co. These two ships, the very finest in the world at that time, helped to make American maritime history.

These sister ships were steel, 554 feet 2 inches long, 63 feet beam, and 15,600 tons displacement. They were twin screw vessels powered by quadruple expansion engines developing

20,000 horsepower. They proved to the world that it was possible for ships of the very highest class to be produced in the United States from American-made materials. The engines of these vessels were the largest and most powerful to be built in America and as the principle of the quadruple expansion of steam had never before been tried on so large a scale the results were watched with interest by the marine engineering profession throughout the world. Structurally the art of naval architecture was exhausted in their design and the skill of the best mechanics of the world went into their construction. Later during the Spanish-American war these vessels were armed and used as scout ships.

The United States ever has been noted for its palatial river and coast-wise boats and a vessel built in 1894 for service on Long Island sound surpassed anything previously attempted in this service. This vessel was the PRISCILLA, built at Chester, Pa., by the Delaware River Iron Shipbuilding Co. She cost \$1,500,000 and was capable of attaining a sustained speed of 22 knots. The PRISCILLA is 440½ feet long, 52½ feet beam, powered with a double inclined compound engine constructed by the W. & A. Fletcher Co., Hoboken, N. J. The high and low pressure cylinders of this engine are 51 and 95 inches in diameter, respectively, with a stroke



Great Lakes passenger and freight steamer Western States, built in 1902

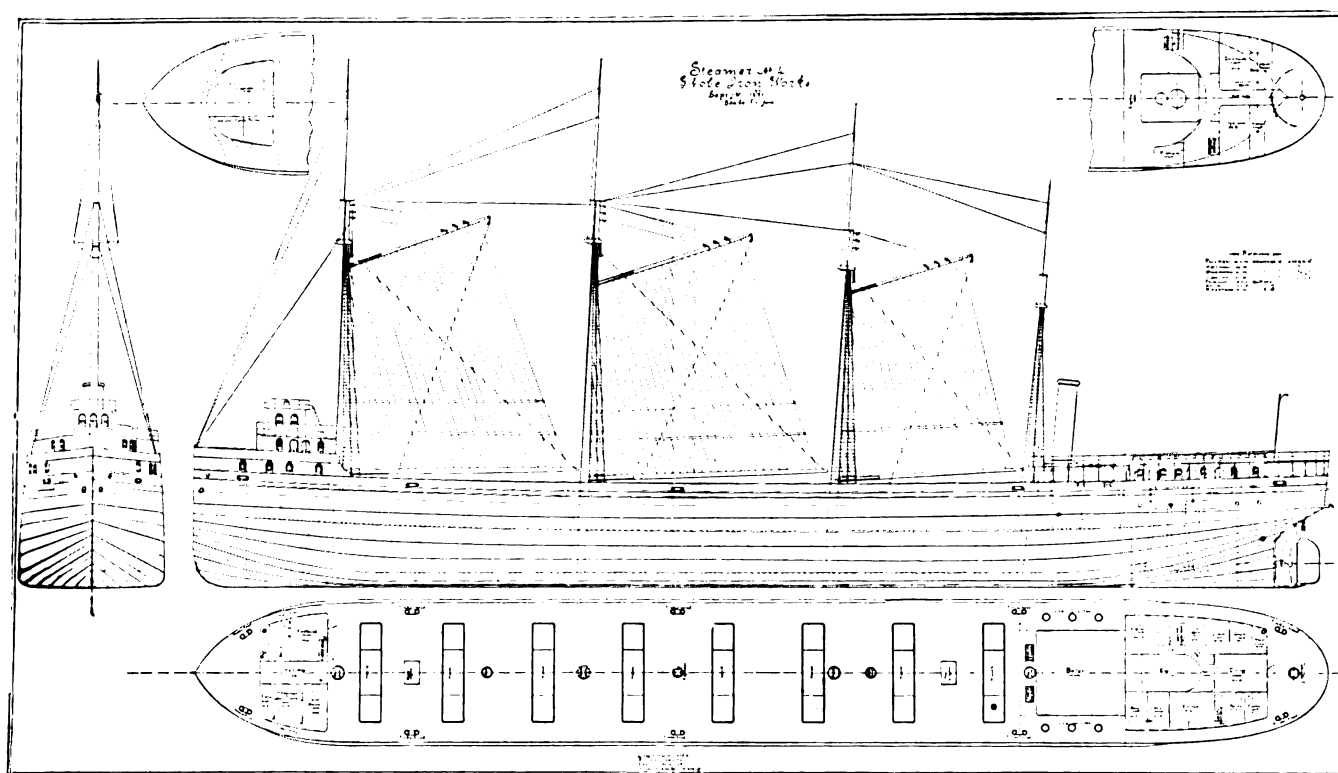
of 11 feet. Her paddle wheels are steel, 35 feet in diameter with 14-foot feathering buckets. This trim craft marked an epoch in American naval architecture as the time honored beam engine was replaced by the inclined compound type.

The largest sailing vessel launched on this side of the Atlantic was the THOMAS W. LAWSON, which was built by the Fore River Ship & Engine Co., Quincy, Mass., in 1902. This remarkable craft was a 7-mast schooner registering 5218 tons. The LAWSON was 375½ feet long, 50 feet beam, 22 feet 9 inches depth, and she carried a crew of 18 men. She enjoyed the distinction of being the largest fore-and-aft rigged vessel ever constructed. Her seven masts each were 155 feet from partners to truck and

she was wrecked she was clearing \$78,000 a year.

The year 1902 also saw the launching of two famous Great Lakes steamers, the EASTERN STATES and the WESTERN STATES. These vessels were sister ships built at the works of the Detroit Shipbuilding Co. for the Detroit and Buffalo Steamboat Co. for passenger and freight night service between Detroit and Buffalo. These vessels were designed by Frank E. Kirby and they offered the last word in design and workmanship for that period and today they are still considered fine vessels. These sister ships are 362 feet long, 80 feet beam over the guards, with a molded depth of 19½ feet. They are side wheelers and are fitted with inclined engines in place of the conventional walking beam type.

development of huge vessels designed especially for this work. While the ONOKO previously mentioned was the original of this type she was a small vessel comparatively speaking for the JAMES A. FARREL, built at the Lorain yards of the American Shipbuilding Co., and launched in the fall of 1912 was the largest lake freighter afloat at that time. This vessel is 600 feet overall, 58 feet beam, 32 feet deep and is powered with a triple-expansion engine with cylinders 24, 39 and 65 inches in diameter with a 42-inch stroke. Her engine develops 1800 horsepower. The FARREL is approximately twice as long as the ONOKO and she depicts graphically the remarkable progress made in lake vessel design and construction in the 30-year period between the building of



Bulk freighter Onoko built in 1882 and the prototype of the present-day ore carrier

under full sail she spread 43,000 square feet of canvas. For easing long hauls and manning sheets and halyards, getting out cargo and manning the capstans she carried six engines. One 40 horsepower engine was located forward to work the main capstan and take care of the two 10,000 pound anchors. The other engines were 25 horsepower each. This remarkable vessel was wrecked on Gunners rock, Sicily islands, in 1907. She was looked upon by many mariners as the beginning of a new era in American shipbuilding. She was a profitable vessel and a good investment for her owners. At the time

The engines are compound with cylinders 52 and 72 inches in diameter with an 84-inch stroke. The high-pressure cylinder is fitted with a double-port slide valve working between double seats so that the valve is balanced after the manner of a piston valve. The low-pressure cylinder valves are triple-ported with ordinary balance plates fitted at the back. The valves are actuated by stephenson link motions. The paddle wheels are of the feathering type 25 feet in diameter.

Demands for the economical transportation of iron ore from the upper to lower lake ports resulted in the

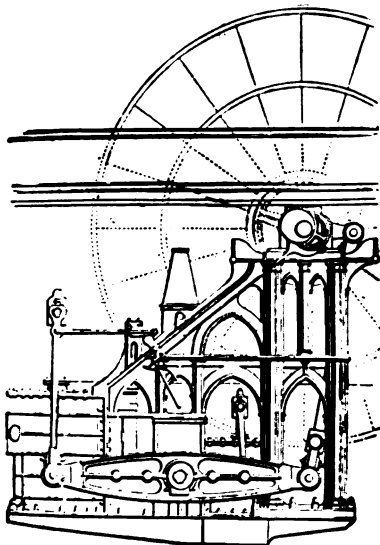
these craft. The FARREL has a net tonnage of 5967.

The year 1912 also saw the launching of the SEE-AND-BEE, designed by Frank E. Kirby, and one of the most famous passenger vessels afloat. This vessel is 500 feet long with a beam of 97 feet 8 inches over the guards, while her molded depth is 23½ feet. At the time she was launched she was the largest side-wheel craft in the world. Her specifications called for a guaranteed speed of 22 miles an hour from dock to dock and she has more than filled this requirement.

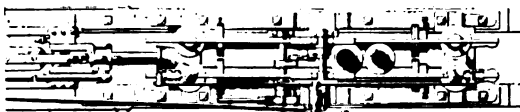
Steel was used in the construction of this vessel to a greater extent than

1878-1928

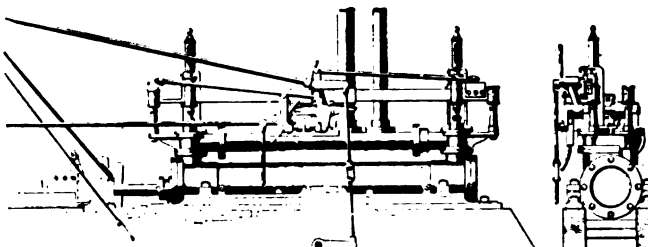
Marine Engines of 50 Years Ago



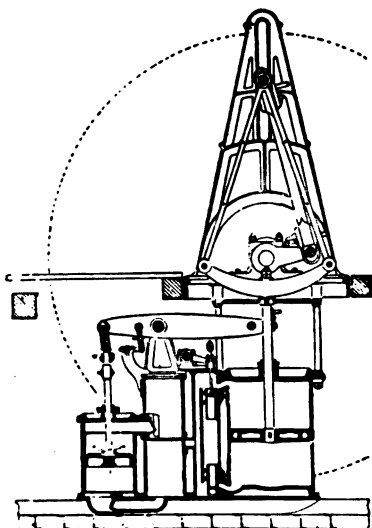
Side Lever Engine



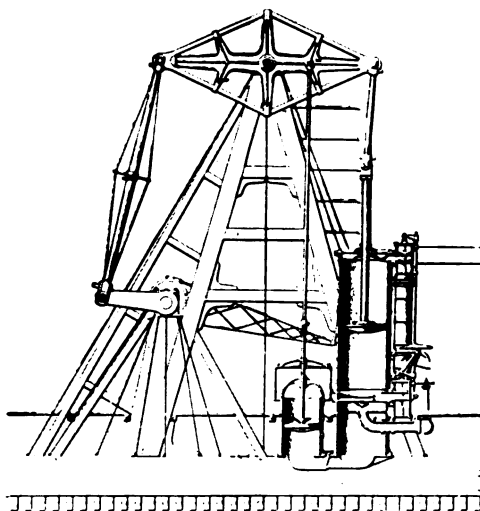
Western River Steamboat Engine



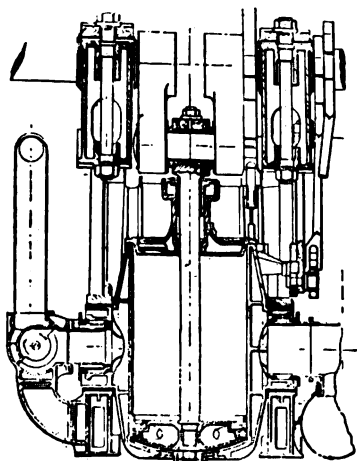
Trunk Engine



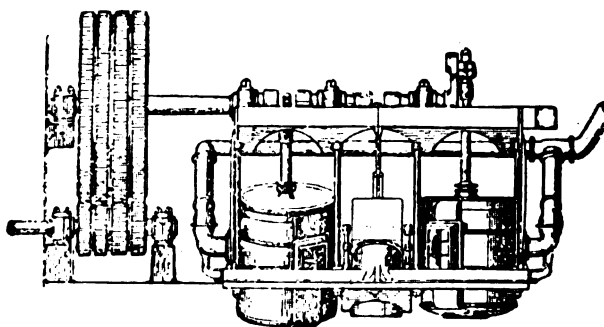
Steeple Engine



Beam Engine



Section Through Trunnions Oscillating Engine



Arrangement of Oscillating Engine

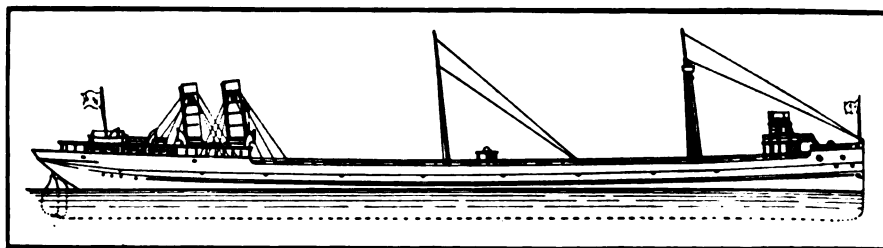
in any other of her type, being carried to the promenade deck. To facilitate quick handling the SEE-AND-BEE is equipped with a bow rudder. Her engine is a 3-cylinder expansion unit of the inclined type with one high pressure cylinder, 66 inches in diameter, and two low pressure cylinders, each 66 inches in diameter, all with a stroke of 108 inches. The engine of the SEE-AND-BEE is a radical departure from accepted practice as the high pressure cylinders are fitted with poppet valves actuated by Walschaert valve gears. Cut-off in the high pressure cylinders is regulated by means of a Sickles gear with a range from $\frac{1}{4}$ to $\frac{3}{4}$ -stroke. The low-pressure cylinder is fitted with a Corliss valve gear. At the time this massive engine was designed, considerable speculation as to the merits of this odd valve gear for marine practice was heard, but it has fulfilled expectations, for the vessel has proven economical in operation. The engine develops 12,000 horsepower, while the side wheels are each $32\frac{3}{4}$ feet in diameter with feathering buckets, 14 feet 10 inches long, and 5 feet deep. Some idea of the immense size of this equipment can be had from the fact that the side wheels weigh 100 tons each, while the main shaft weighs 120 tons.

Famous Hudson River Craft

Mention should also be made of another famous side wheeler constructed during 1913. This vessel, the WASHINGTON IRVING, was designed by Frank E. Kirby and J. W. Millard and built by the New York Shipbuilding Co. for the Hudson River Day line. In designing the hull, various models were tested by Professor Sadler and the architects in the model basin at Ann Arbor with special reference to developing lines that would make the least disturbance in shoal waters at fast speeds. One result of the tests was a torpedo stern; an innovation for passenger steamers. The WASHINGTON IRVING is 416½ feet long, 84 feet beam, and 14 feet 2 inches deep. She was a side wheel vessel powered with an inclined type, 3-cylinder engine, with a 45-inch high pressure and two 70-inch low pressure cylinders, all with an 84-inch stroke. The WASHINGTON IRVING was a typical Hudson river boat in all respects; fast, safe and handsomely decorated. This fine vessel was rammed in 1926 and sank in the Hudson river near the Jersey side, becoming a total loss.

Next comes the shipbuilding period wherein United States shipyards under the direction of the United States Shipping Board Emergency Fleet Corp. made history. When war was

declared we had a little over 8,000,000 tons of ships afloat. During the high peak of activities 1922, we had 18,500,000 tons. This marvelous undertaking taxed the energies of the nation to the utmost, but it proved to the world that the United States was in a position to build ships—and build them fast. At the beginning of the program there were less than 50 shipyards in the United States capable of building ocean-going vessels. When the armistice was signed there were 186 plants in operation. The Emergency Fleet Corp. built and delivered in a single year more than 31,000,000 deadweight tons of shipping, far more than the greatest output of any other nation in a like time. American efficiency methods applied to shipbuilding cut the time required to build a modern vessel from 3500 to 9000 tons from nine months to a year and a half down to 30 to 120 days. In one yard a vessel was launched and completed in less than 70 days.



Largest freighter on the Great Lakes in 1898—the Samuel F. B. Morse

Much has been written about the wooden ships built as an emergency measure and while it often is conceded that this venture was a failure the fact remains that when the war ended 86 wooden vessels were in operation. This is evidence that the wood shipbuilding program was *not* a failure. The sole object of building wooden ships was to provide immediate ocean tonnage and to provide it quickly.

Wooden shipbuilding was comparatively a lost art. Never before had a wood steamship of over 3500 tons deadweight been constructed. All told, as far as the emergency is concerned, the wood ships did excellent service, as they released valuable steel tonnage for transatlantic service.

The concrete ship was another war experiment. The most remarkable concrete vessel to be constructed was the FAITH, a ship of 5000 deadweight tons. Notwithstanding that the FAITH rode out storms of hurricane proportions she stood the test well. She sailed from San Francisco to Seattle and later to South American ports. Still later she came through the Panama canal to New York, where she was visited by many experts of

the Emergency Fleet Corp. and others who pronounced her seaworthy in all respects. She proved reasonably economical as a cargo carrier, although her cost of operation was slightly higher. What concrete vessels could have accomplished in an emergency is never known as the armistice came before the development was fairly under way. For a complete description of the stupendous task performed by the Emergency Fleet corporation the reader is referred to *Building the Emergency Fleet*, by W. C. Mattox, which volume is truly a classic in shipbuilding literature and a work that should be read by every patriotic American.

Shipbuilding in the United States today is established on an efficient basis and no better products are afloat than those of American yards. The ocean bulk freighter CHILORE is an excellent example of a present-day American vessel. This craft was designed by Hugo Frear and built at

the Bethlehem Shipbuilding Corp., San Francisco, in 1922. She is a steel ship constructed on the Isherwood system of framing with machinery in the stern and was designed to carry ore and coal between the United States and Cuba and Chile. She is 571 feet 6 inches long, 72 feet beam, and 44 feet deep, while her net tonnage is 8393. She is an oil burner and fitted with a Curtis turbine engine of 5000 shaft horsepower.

The EL OCEANO is another latter day American vessel designed by A. S. Hebble and built by the Federal Shipbuilding & Dry Dock Co. She is 433 feet long, 56-foot beam, with a net tonnage of 4100. Her main engine is a De Laval cross compound turbine which drives her at a speed of 15 knots.

The GREATER DETROIT and GREATER BUFFALO, sister ships designed by Frank E. Kirby and built by the American Shipbuilding Co., Cleveland, each at a cost of \$3,500,000, are outstanding lake passenger vessels of the present day. These magnificent vessels are 535 feet long, 96½-foot beam over the guards, 23 feet 7 inches deep, with a gross tonnage of 7740.

(Continued on Page 110)

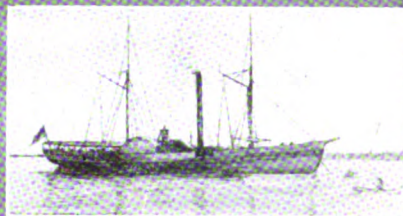
1878 1928



CLERMONT—1807



DEMOLOGOS—1814



WALK-IN-THE-WATER—1818



SAVANNAH—1819



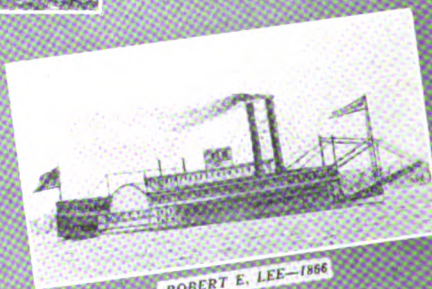
VANDALIA—1841



MARY POWELL—1861



MERCHANT—1862

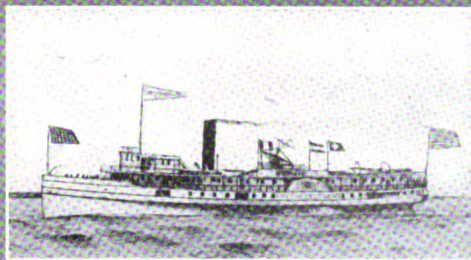


ROBERT E. LEE—1866



CITY OF PEKING—1874

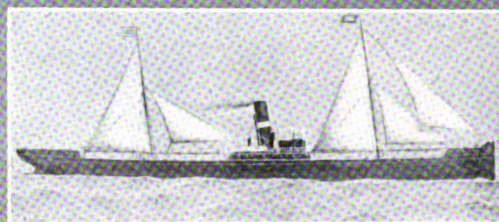
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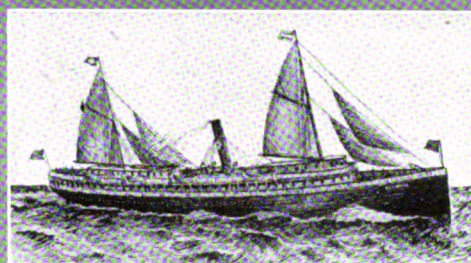
CITY OF CLEVELAND—1880



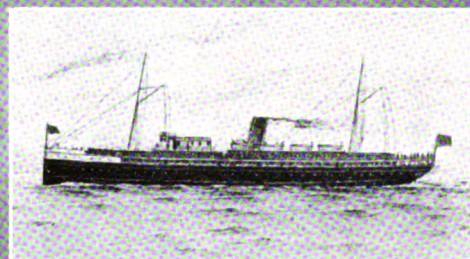
COLUMBIA—1880



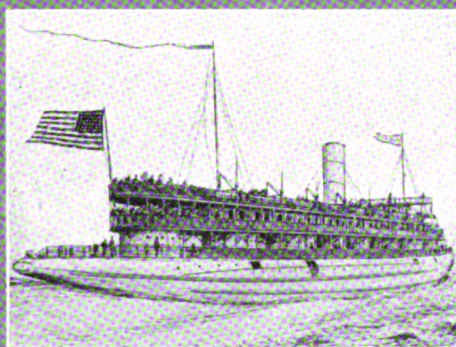
WINIFRED—1898



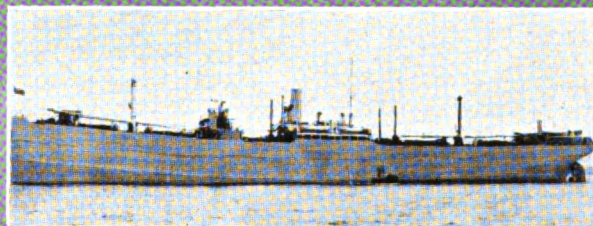
OLIVETTE—1887



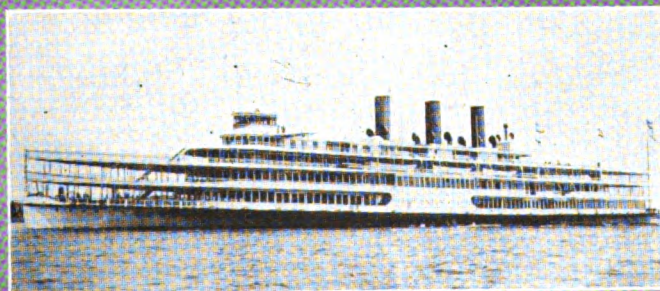
VIRGINIA—1891



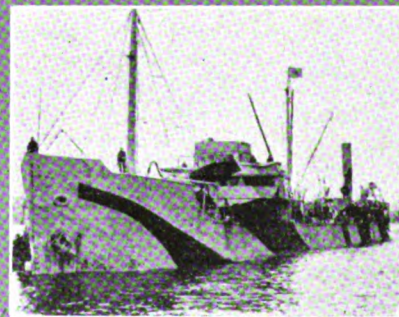
CHRISTOPHER COLUMBUS—1893



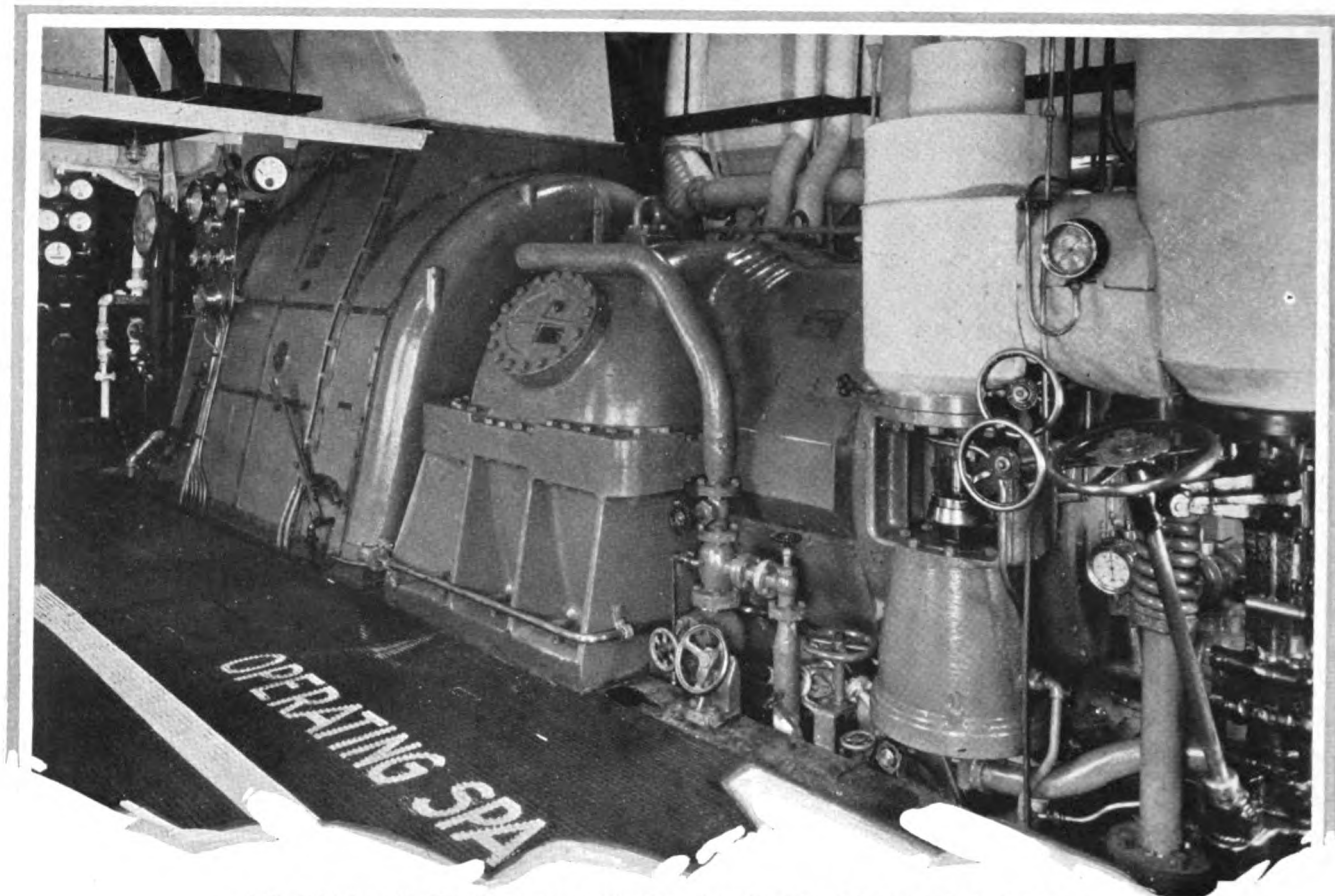
DEFIANCE—1918



WASHINGTON IRVING—1913



CONCRETE SHIP FAITH—1918



A Real Modern Engine Room—Port Side Propulsion Turbine Generator, S. S. California

Progress Made in Engineering

Remarkable Improvements in Machinery for Vessels During 50 Years—Simple, Compound, Triple Expansion Engines—Turbines and High Steam Pressures—Diesel

By Capt. Walter M. McFarland

Past President, Society of Naval Architects and Marine Engineers

MARINE REVIEW has referred to me as the "Dean of marine engineering in the United States." As a matter of fact its own semi-centennial almost coincides with mine as an active marine engineer. I graduated from the Naval academy as a cadet engineer in 1879, so that my personal experience of the last 50 years covers the same period as that of the existence of the MARINE REVIEW. The editor has asked me to contribute a sketch in the way of personal reminiscences covering this period. To attempt anything like a complete chronological or historical review would run to great length and really would not cover what is wanted. I take it that his idea was to get the personal recollection of one who has passed through this period as to the

important events which have occurred.

On thing which is impressed upon any observer, on looking back over a long stretch of years, is that there are no sharp lines of demarcation between different periods. For example, simple engines continued to be built long after compounds were in general use, and likewise the same was true when the triple expansion engine came along. Even today, when the turbine has so thoroughly proved its excellence, there are many installations of reciprocating engines. Nevertheless it is a convenient way to realize the general steps of progress to designate them as the period of the simple engine, of the compound, the triple expansion and the turbine.

In 1878, the compound engine was thoroughly established as the latest development in marine practice, with boiler pressure running anywhere from 80 to 100 pounds. When sizes became large it was quite common to find the low pressure divided into

two cylinders, making the three cylinder compound engine. Weights were high and speeds low. Complete machinery installations ran from 4 to 5 horsepower per ton, while the economy as measured by coal per horsepower was from $2\frac{1}{2}$ to 3 pounds. The propeller had come into universal use for seagoing vessels but the paddle wheel was still common on our rivers, bays and sounds, with the stern wheel steamer in use in our very shallow western rivers, where it still retains its place. Some of the largest and finest of the Hudson river and Long Island sound paddle wheel steamers were yet to be built. As showing how simple engines in old vessels were still in use, I may mention that I served for more than a year as the assistant engineer on the old MICHIGAN (more recently called the WOLVERINE) on the Great Lakes. She had side wheels driven by inclined engines operated by Sickles cut-off.

The author, Capt. W. M. McFarland, past president of the Society of Naval Architects, in his earlier years served under Admiral Melville and is equally familiar with naval and merchant marine engineering practice.

When I was there in 1882 and 1883, we carried 19 pounds pressure, and made 19 revolutions per minute and about 10 knots speed.

At this time, and dating back to 1858 when she was built the GREAT EASTERN was the largest vessel afloat, of about 32,000 tons displacement. She retained this position until 1901 when her displacement was exceeded by that of the CEDRIC and CELTIC of the White Star line, which were of about 38,000 tons displacement. The GREAT EASTERN was a wonderful vessel, but unfortunately ahead of the time when the economy of machinery and the amount of business could make such a big ship pay.

Cylindrical Boiler in Use

There were still in use many box boilers, that is, boilers with flat sides and depending entirely on bracing for strength, in the older vessels with simple engines, but for compound-engined ships the cylindrical or scotch boiler was generally used and continued the favorite for many years. Indeed, there are people today who do not seem to have heard that there is anything better, in spite of the extended use of water-tube boilers for the past thirty years. Freak boilers of various kinds were used occasionally, such as flat-sided boilers with semi-cylindrical tops and bottoms to enable the space to be utilized more fully, but these soon disappeared in favor of the truly cylindrical boiler.

It was about this same time that a momentous change in materials of engineering began to appear, in the substitution of mild steel for wrought iron, both for boiler plate and for engine forgings. Great skill had been acquired in the manufacture of the wrought iron materials, for which the manufacturers deserve great credit, but, when mild steel was developed so as to be reliable, its many advantages caused it to displace wrought iron entirely. Some have maintained that boiler tubes of wrought iron are superior to those of mild steel, but the fact is that today the vast majority of the boiler tubes are made of mild steel. Just here, it is worth while to comment on an experience in the early days of mild steel which should be a warning to engineers not to neglect peculiar conditions which appear or to deny their possibility, but to endeavor to ascertain the cause and either remove or avoid it. The new material was received with enthusiasm, it was assumed that anything could be done with it and that it could withstand almost any kind of treatment. Very soon mysterious failures of sheets and forgings appeared and caused the

most serious apprehension. Careful investigation showed, however, that these troubles were due to working the material at what was known as "blue heat," the name explaining the condition. When this was realized and this particular range of temperature avoided, the troubles ceased entirely.

While mentioning the great improvement in materials, it is important also to note that there had been gradually a great improvement in workmanship. This permitted higher piston speeds and revolutions per minute to be attained, particularly the latter, which was one of the big elements in the reduction of weight. I well remember that in my early days it was assumed as a matter course that bearings were almost sure to



Capt. W. M. McFarland

overheat at times so that provision was made for the application of a spray of cooling water. When it was possible to get the benefit of the improvement in workmanship, including alignment, the necessity for this application of cooling sprays almost entirely disappeared, although they are fitted as a precaution.

In the early days of the compound engine it was not thoroughly appreciated that the increased economy was due, not so much to higher pressures and increased ratio of expansion, as to dividing the expansion into two stages, so that the range of temperature in a single cylinder would be greatly reduced. Even that standard work, Rankine's "Steam Engine," as late as the edition of 1878, contained this statement:

"The economy due to expansion is entirely independent of the number of cylinders and will be the same with the same ratio of expansion whether

that takes place in one, two or a dozen cylinders."

Experimentation and study showed that this was entirely erroneous.

With the improvement in materials and the possibility of carrying higher pressures, the next step was really obvious, namely, to have expansion in three stages instead of two, which meant the triple expansion engine as a further step in progress beyond the compound. There is some dispute as to the credit for the introduction of the triple expansion engine, but usually it is considered that the placing of a set of triple expansion engines in the ABERDEEN by Dr. A. C. Kirk of R. Napier & Co. of Glasgow, about 1882, was the real beginning. By this time the theory of multiple expansion was understood and thereafter the triple expansion engine with pressures up to 200 pounds took possession of the field. These were built in some cases of very large size. Just as was the case with the large compound engines, the low pressure stage was divided between two cylinders, thus making a four cylinder engine. There was a further extension of the principle into the expansion in four stages, or quadruple expansion engine, with pressures up to 250 pounds. Some of these were built, but about the same time the steam turbine began to show its merits, so that their number was never very great. In 1880, a little boat called the ANTHRACITE was built by Loftus Perkins, an American long resident in England, which carried 500 pounds pressure to work with triple expansion. This was so much ahead of practice at the time that nothing came of it and we are only now, fifty years later, beginning to use such pressures in marine practice.

Naval Requirements Help Progress

The favorite boiler with the triple expansion engine was the scotch or cylindrical type, both single and double ended. The double-ended boiler was of course lighter than two single-ended boilers of the same amount of heating surface and for large installations was universally used. The machinery for naval vessels has always had one marked distinction from that for merchant vessels, in the vital necessity of keeping weight at a minimum. This was particularly the case in the class of vessels which developed after the invention of the Whitehead torpedo with its own machinery operated by compressed air. To get the full benefit of the torpedoes it was necessary to have them launched from very swift vessels of small size. Accordingly the engines

of these small vessels had a very high rate of revolution and the boilers were generally of the marine locomotive type for the purpose of reducing weight.

As speeds of revolutions for engines increased, and particularly in the very fast-running, light engines of the torpedo vessels, the phenomenon of vibration became pronounced. As usual all sorts of explanations were offered, most of which were wrong. It remained for Sir Alfred Yarrow, who carried out a brilliant series of experiments, to prove that these vibrations were due to forces and couples developed in the engine. His experiments were made with a three-cylinder engine and the remedy was additional or "bob" weights, located at the ends of the engine somewhat like cross heads, and driven by eccentrics set at a suitable angle. There were other students of vibration, among them Doctor Schlick of Germany. He had been working with the four-cylinder triple expansion engine of larger powers, and had the cleverness to see that it was possible to utilize the information resulting from Yarrow's experiments to make the four-cylinder engine almost perfectly balanced, by treating the piston and other moving parts of the fourth cylinder as the equivalent of Yarrow's "bob weights." This led to what was known as the Yarrow-Schlick-Tweedy system of balancing, which has continued to the present.

Watertube Boiler Is Used

The water-tube boiler was one of the first used in steam vessels, although to a very limited extent. In 1804 Col. John Stevens, of the famous Stevens family of Hoboken, N. J., built a small steamer whose boiler was a combination of small water tubes. Only a few of these boilers were built and for a long time all marine boilers, as has been stated, were of the box type and, later, of the scotch or cylindrical type. On shore, however, water-tube boilers began to be used more or less extensively prior to 1860, and by the period which we are now considering (say, the last decade of the 19th century) their use was widespread on shore. It became evident to progressive naval designers that it was folly to carry around the great weight of heavy shell and water in the scotch boiler when the water-tube boiler would weigh less than half as much. The day of the scotch boiler ended with pressures of 200 to 225 pounds per square inch. Above this, the thickness of shells in large boilers with the great weight became prohibitive. Accordingly pre-

liminary and experimental installations of water tube boilers were made in the navies of various countries. In our own, in 1888, the manufacturers of water-tube boilers were invited to submit plans for boilers for a coast defense monitor, afterwards known as the MONTEREY, and also to agree to a competitive test of their boilers. Tests were made in the latter part of 1889 and early in 1890, as a result of which the boiler designed by Charles Ward of Charleston, W. Va. was selected and subsequently four of them were built and placed in the MONTEREY.

Higher Steam Pressures Introduced

The invention of some form of water-tube boiler is an easy thing for any engineer of an ingenious turn of mind, and a great many varieties were brought out, although they really formed only a very few types. Today the division may be reduced to two chief classes. Small tube boilers, of the express type, used almost entirely in naval service, consist of three drums with two banks of tubes joining the large upper drum with the two smaller lower drums, one on each side, thus forming an "A" shaped boiler. The tubes in these boilers may be of almost any shape, but, generally speaking, they are either curved to a large radius or else are straight for most of their length with curves at the ends where they enter the drums. These boilers can be built when fitted with 1-inch tubes so as to weigh, including water, as low as 10½ to 11 pounds per square foot of heating surface. The other type of water-tube boiler, of which the Babcock & Wilcox is a notable example, has only one drum for steam and water. The heating surface in the tube bank consists of straight tubes expanded into sectional headers, or large water boxes and with the tubes set at an angle of about 15 degrees. This type of boiler is also much lighter than the scotch, where the weights for pressures as high as 200 pounds were, including water, 60 pounds per square foot of heating surface. Water-tube boilers when fitted with 2-inch tubes have weighed as little as 25 pounds per square foot of heating surface, including water.

Mention was made of the ANTHRACITE with 500 pounds pressure and one vessel, the KING GEORGE, has now been in service for a year carrying 550 pounds. Some of the more enterprising superintending engineers in our own country have stated that they are ready to carry pressures as high as this in new vessels. In this connection it is important to notice

that boilers of the Babcock & Wilcox type, with only a single drum, are much better adapted to these high pressures than the three-drum type. In the case of the express type boiler of the KING GEORGE the upper drum is a forging, with the tube sheet about 3 inches thick. In the other type of boiler, the thickness of the drum shell for 550 pounds pressure would not be more than 1½ inches.

The most revolutionary change in marine steam practice has come with the introduction of the steam turbine in replacement of the reciprocating engine. The principle of the turbine is very old. Indeed, one of the very first forms of steam apparatus, known as the Eolipile, embodied the principle of the Parsons turbine, that is, the reaction effect of the steam. Sir Charles Parsons deserves the greatest credit for his brilliant work in the development of the steam turbine, against great discouragement. His early examples worked, but they used so much steam that, except for very special service, their use was impossible. He finally adopted stage expansion, which is analogous to the compound and triple expansion engine in reciprocating work. This has gradually secured economies in large sizes which were undreamed of by engineers in the days of reciprocating engines. When these are combined with the latest developments of economy in boilers, overall thermal efficiencies have been attained which are close to those of the best internal combustion engines.

Steam Turbine Greatest Advance

An essential for economy with the turbine is high speed of rotation, which lends itself to reduction in weight. For marine applications, however, this is inconsistent with propeller efficiency. The earliest installations of turbines were a compromise where the speed was higher than the efficient speed for the propeller and very much below efficient speed for the turbine. The late Admiral George W. Melville, engineer-in-chief of our navy for sixteen years, was the first to advocate the reduction of turbine speed to that suitable for the propeller by means of mechanical gearing. In this he was backed by the late George Westinghouse, who had retained his interest in marine affairs from his early days as a young engineer in the United States navy during the Civil war. Westinghouse placed his facilities and capital at Melville's disposal for the development of the "reduction gearing." It is interesting to note that the first experimental gear was of

(Continued on Page 112)



Pratt School of Naval Architecture and Marine Engineering, Cambridge, Mass.

Vital Influence of Education In Ship Design and Construction

By Henry H. W. Keith

Professor of Naval Architecture, Massachusetts Institute of Technology

THE influence of education in any industrial work is sure to become more and more pronounced as time goes on, and this is especially true in shipbuilding, that is, in naval architecture and marine engineering. In the days of wooden sailing ships, the design and construction of vessels was largely a matter of practical experience.

With the advent of large iron and steel ships, and with the introduction of machinery, all this was changed. It then became necessary to make numerous plans and calculations in advance of the building of the ship, and it was soon realized that these must be based upon the fundamental principles of science, otherwise failure would result. For example, the questions of strength, speed and power, and fuel economy, which were comparatively unimportant in wooden sailing ships, became of great importance in large steel steamships, and had to be treated as engineering problems before a successful ship could be built. Without some scien-

tific and technical education, the engineer is forced to use rule-of-thumb methods, and although these may be safe when based upon exactly similar previous conditions, it is expecting too much of them to assume that they hold for new and untried conditions.

Technical Education Necessary

In marine engineering, nowadays, a technical education is especially necessary. When one considers the numerous types of machinery in use at the present time, and the possibility of the introduction of others, it is apparent that only a sound basis in the fundamentals of mechanical and electrical engineering will enable the future designer to handle the problems which will certainly be given to him. For instance, in marine engineering we are now using for motive power, steam and oil engines, steam turbines, and electric motors, for fuel, we are using coal, oil, gasoline, etc.; high pressure steam has come into use for boilers; new types of auxiliary machinery are constantly being developed; all of which com-

plicate the problem, and require specialized training. Education is therefore bound to take on an increased importance.

Probably the best sources of information in naval architecture and marine engineering are the papers of technical societies, such as the Society of Naval Architects and Marine Engineers in this country, and the Institution of Naval Architects in Great Britain. The designer, builder, or operator who has not had the advantage of a technical education cannot possibly derive full benefit from these papers, and therefore will be under a serious handicap.

Since technical training is required for a naval architect and marine engineer, and although there may be differences of opinion as to the details of such training, it is now generally agreed that at least a part of this training must be obtained in a technical school.

A large modern ship, whether for war purposes or trade embodies such a variety of engineering problems that her design and construction

would be impossible without an understanding of the principles involved. These principles require, among other things, a knowledge of mathematics, physics, chemistry, strength of materials, heat, electricity, hydraulics, and metallurgy. It is desirable that a trained engineer should have in addition a knowledge of some of the more general subjects in education, such as English, languages, economics, and history.

Begin Teaching Naval Architecture

In shipbuilding the same is also true. Two schools for naval architecture were founded in Great Britain early in the last century, but were abolished later, and in 1864 the Royal School of Naval Architecture and Marine Engineering was founded, and this carried on until 1873. When this school closed the Royal Naval College at Greenwich was opened, and in 1884 a professorship of naval architecture was established at the University of Glasgow, to be followed later by similar professorships at Newcastle-on-Tyne and Liverpool. In Germany, schools of naval architecture have been established for some years at Charlottenburg and at Dantzig (1904), and in France there is the well-known Ecole du Genie Maritime at Paris.

In the United States, complete courses in naval architecture are given at the Massachusetts Institute of Technology, University of Michigan, and the Webb Institute of Naval Architecture. In the past, Cornell university and Lehigh university have had such courses.

Naval architecture at the Massachusetts Institute of Technology was first given as an option in the course in mechanical engineering. Later this course grew to be of sufficient importance to be made a department by itself and was extended to include not only naval architecture, but marine engineering as well. Prof. C. H. Peabody was placed in charge, and the first degrees were given in 1895. As now constituted the course offers a sound training in the design and construction of ships and their machinery, and in yacht design. It has recently been extended to include an option in ship operation.

Prior to 1901, American naval officers were educated in a professional capacity as naval constructors at Greenwich, Glasgow, Paris and Charlottenburg, but at this time the standard of scholastic work at the Institute of Technology was such that it was selected by the bureau of construction and repair of the United States navy to give the professional training required by its members

after being graduated from the Naval academy at Annapolis.

The special course of study taken by the naval constructors leads to the degree of master of science. It is laid out with the advice of the United States' navy department and adds to the training already given at the Naval academy, the subjects peculiar

Need Naval Architects

IT IS necessary for the good of any industry to attract to it young men of ability and talent. The rewards in one way or another must be adequate. This is emphasized in the letter quoted below from Rear Admiral F. R. Harris, U. S. N. Retired to John T. Doyle, secretary of the United States Civil Service Commission, Washington. In his letter dated May 22, Admiral Harris said:

"I have your circular letter of May 15 and will be glad to do anything I can to assist you in connection with architectural draftsmen, but would like to bring to your attention that the pay offered is entirely inadequate and I could not recommend any first-class man to enter the service at any such compensation. The pay for a naval architect with two years' experience in responsible charge of design is \$200 per month and the pay for an associate naval architect with three years' experience in responsible charge is \$250 a month.

"I find it extremely difficult to get any young men with experience. As an example: In my own office, the juniors with little or no experience receive a minimum pay of \$225 per month; experienced men receive from \$275 to \$350 per month, which is from \$3300 to \$4200 per year and even these men are not in responsible charge. The designer in responsible charge gets \$5000 a year.

"I would say that your complaint in not being able to get technical men skilled in naval architecture is due to the fact that you do not pay enough."

to naval architecture as well as those which will best enable a naval constructor to meet the special requirements of his position.

It is believed that a description of the courses now given in naval architecture and marine engineering by the Massachusetts Institute of Technology, under the direction of Prof. James R. Jack, will prove of interest to the reader, and will serve to show the basis upon which these courses are established.

Three courses are given, viz: Naval architecture and marine engineering (course XIII, option 1); ship operation (course XIII, option 2); naval

construction—graduate course (course XIII-A)

In the first year the instruction is practically the same as for all students, being concerned especially with the subjects upon which the later professional work is built. These subjects are: Chemistry, descriptive geometry, English and history, mathematics, drawing, military science, physical training, and physics.

In the second year, a beginning is made in professional work. It will be noticed that the subjects include training of the hand as well as the mind, shop work being considered an essential part of the course. The classes in ship drawing are devoted to training the students in the use of the special instruments and methods required in the descriptive geometry of a ship's hull. A beginning is made in yacht and ship construction in which he learns the various types of vessels and the names and properties of the different parts. The subjects given in the second year are: Applied mechanics, English and history, forging, foundry, mathematics, mechanical engineering and machine drawing, mechanism, military science, physics, ship construction, and ship drawing.

In the third year the student starts fully on professional work. In the drawing classes a type of ship in which he is specially interested is selected, and he prepares a design, makes the principal calculations for hull and machinery, and also makes a model from the ship's lines.

The third year subjects are: Applied mechanics, engineering laboratory, heat engineering, machine tool laboratory, marine engineering, materials of engineering, naval architecture, political economy, ship construction, ship design, and general study.

Fourth Year Studies

In the fourth or senior year, the professional work is continued and extended to include not only the construction of the ship and its machinery, but also the organization and management of the shipyard for efficient and economical production. Associated with this is a course in accounting which deals with the financial aspect of engineering problems. Recently, the students have been required to take general studies, which being designed to counteract the narrowing tendency of a purely professional education, are chosen from subjects as far removed as possible from professional work.

In the final term the student is required to write a thesis on a subject approved by the department. Considerable latitude is allowed in

the choice of the subject, and the thesis does not necessarily contain absolutely original work, but the student is required to show diligence in collecting available data concerning the subject, to show system and method in arranging the material and to draw a sound and logical deduction from his material.

The fourth year subjects are: Accounting, applied chemistry, electrical engineering elements, electrical engineering laboratory, engineering laboratory, hydraulics, marine diesel engines and auxiliaries, marine engine design, marine engineering, naval architecture, ship design, shipyard organization, steam turbines, testing materials laboratory, and general study.

The subject of naval architecture begins with consideration of the units employed and the derivation from first principles of the various methods and formulas which are used in practice for determining displacement, stability, and trim, strength, speed and power and other technical qualities of ships. Both the theoretical and practical problems of launching are considered. The influence of the tonnage and freeboard laws of various countries is considered and attention is given to the theory of deep sea waves and their effect on the strength of the vessel and her speed. The rolling of ships is investigated

and the influence of subdivision by water-tight bulkheads on the safety of a ship when damaged by collision or grounding is also taken up.

In the marine engineering classes considerable time is spent on the screw propeller and its design, as well as on the more practical application of principles previously studied in heat engineering. The historical development of the marine engine and boiler is traced and the important elements of the design in modern steam machinery are gone into in considerable detail so that the advantages and disadvantages of different methods of propulsion can be compared.

Ship Operation is Studied

The course in ship operation given by the department of naval architecture and marine engineering is of recent origin, having been established in 1925. It is designed to prepare men for ship operation and management, or other maritime pursuits, such as insurance, admiralty law and transportation.

The new course is broad, covering the basic sciences, general studies, economics, business administration, the principles of mechanical and electrical engineering, a technical study of ships and their machinery, and ship operation. In many respects, it parallels the course in engineering

administration given at the institute.

The third year subjects are: Applied mechanics, banking, corporate finance and investments, corporate organization, engineering laboratory, English, forging, heat engineering, marine engineering, naval architecture, ship construction, shipping administration, statistics, and terminal facilities.

The fourth year subjects are: Applied chemistry, business law, cost accounting, electrical engineering, engineering laboratory, foundry, industrial relations, machine tool laboratory, marine diesel engines and auxiliaries, marine engine design, marine engineering, materials of engineering, ship design, ship operation, steam turbines and auxiliaries, testing materials laboratory, general study, and thesis.

Shipping administration, given in the third year, is a subject specially prepared for this new course, and deals with freight and passenger traffic, chartering, brokerage, agreements and conferences, wharf management and marine insurance. Terminal facilities is also a specially prepared subject, taking up the layout and facilities of the world's leading ports, the handling of ships' cargoes, piers, transit sheds, warehouses, railroad facilities, cranes, etc.

Ship operation, given in the fourth year is one of the most important



Main Educational Group of the Massachusetts Institute of Technology—Pratt School of Naval Architecture and Marine Engineering at Extreme Left Attached to Main Group

features of the course. A detailed study is made of the items concerning operating expenses and incomes, and typical problems are assigned in which the expenses of ships on various trade routes are worked out and the estimated profits are calculated. Comparative studies are made of economy, using various kinds of fuels and different types of machinery. Other items covered in this subject are: repairs, upkeep, docking, influence of the size and speed of ships upon operating costs, deadweight, influence of form, coefficients, and propeller characteristics on propulsion in rough weather, cargo handling, and the design of ships from the point of view of the owner.

In view of the present condition of the merchant marine of the United States, the demand for men trained in ship operation is not large but it is believed that international competition will soon demand that more attention be given to the economic operation of ships and the opportunities of men who have had the requisite training in this work should be especially good.

The following table shows the percentage of the total number of hours of class work and preparation devoted to various subjects during the four-year courses in naval architecture and marine engineering (option 1) and in ship operation (option 2).

	Option 1 Per Cent	Option 2 Per Cent
Chemistry and Physics	16.4	16.5
Mechanical Drawing & Mechanism	7.2	6.7
English, History & Gen. Studies	12.1	10.2
Mathematics	9.1	9.1
Military Science & Phys. Training	3.7	3.7
Applied Mechanics	7.8	7.4
Heat Engineering & Eng. Lab.	7.1	6.1
Mechanical Arts	4.0	1.5
Electrical Engineering	3.5	2.5
Naval Architecture		
Ship Construction }	13.4	6.9
Ship Design		
Marine Engineering		
Ship Operation }	7.3	5.3
Terminal Facilities }		
Economics and }		
Business Studies }	5.3	19.3
Hydraulics	1.3	
Thesis	1.8	1.8
	100.0	100.0

In addition to the four-year course in ship operation, special courses are also offered by the department for men already engaged in this work. These courses are intended for men above the usual age of undergraduates who from their training and experience can profitably undertake the work. In general, the classes meet once a week for a term of fifteen weeks, and there is a one-hour lecture period followed by a half-hour discussion.

Naval Construction Course

The course in naval construction given at the Massachusetts Institute of Technology is a graduate course, since it is additional to that given at

the United States Naval academy.

A naval constructor begins his career as a midshipman, and after a four-year course at the academy, is graduated with the rank of ensign. He is then assigned to service at sea for a period of about two years, during which time he serves in the capacity of a line officer. After this duty, he is sent to the post graduate school at Annapolis where he is given a year's course in mathematics, applied mechanics, thermodynamics, electricity, physics and chemistry. At the end of this instruction, he is taken into the construction corps and is sent to the Massachusetts Institute of Technology for a two-year course in naval construction.

Subjects in Senior Year

The subjects given in the senior year, are as follows: Alternating current, business law, electrical engineering laboratory, internal combustion engines, marine engine design, marine engineering, merchant shipbuilding, model making, naval architecture, political economy, shipyard practice, steam turbines, theory of warship design, and warship design.

In the following or graduate year the subjects are as follows: Aeronautics, naval architecture, precision of measurements, rigid dynamics, structural design, structures, theory of warship design, warship design, and thesis.

In the first part of the graduate year the lectures given in theory of warship design cover the following topics: Structural design, comprising the materials used in hull construction, the strength calculations of the entire hull, as well as of its various members; a discussion of riveted joints; a history of the development of machinery; preliminary design and installation of boilers, engines, and propellers; oil fuel; rudders and steering gear; drainage, etc.

In the second term, structural design is continued, the lectures comprising plating, framing, decks, bulkheads and stem and stern construction. Other topics covered are anchors and anchor gear; boats and boat handling; turrets; effects of underwater explosions and protection against such attack; strength of submarines; docking stresses; ventilation; heating, etc.

As in the case of the regular students in naval architecture, the naval constructors are required to prepare a thesis which is expected to be a more or less original analysis or research in some subject pertaining to naval construction.

Aeronautical subjects are becoming more and more important for constructors in the United States navy,

and many of the men who have taken the course in naval construction at the institute are now assigned to duties in connection with naval aeronautics. It is expected that in the future, these subjects will receive still more attention, and advantage will be taken by the students in naval construction of the new and completely equipped Guggenheim aeronautical laboratory just established (1928) at the institute.

During the summers following the senior and the graduate year the naval students are engaged in practical work at navy yards.

Summing up the training of a naval constructor, it will be seen that he is under actual instruction in school for a period of about seven years; four at the Naval academy, one at the post graduate school at Annapolis, and two at Technology. In addition to this time, he spends about two years at sea and two summers at navy yards.

For further information concerning education of the construction corps of the United States navy the reader is referred to the excellent paper read in 1919 before the Institution of Naval Architects by S. V. Goodall, R. C. N. C.

Facilities and Equipment

The institute is located advantageously for its students in naval architecture. In Cambridge, just across the Charles river from Boston, it is near the Boston navy yard, and to the numerous shipping activities of the port of Boston. Repair plants, such as the Simpson plant of the Bethlehem Shipbuilding Corp., Ltd., and the Atlantic Works are easily accessible. Yards, such as Lawleys, where sailing and motor yachts are built are close at hand, and the well known Fore River plant of the Bethlehem Shipbuilding Corp. Ltd., located at Quincy, Mass., is only a short distance from the school.

In view of this, it has been possible in the past to have the students take part in many investigations such as speed trials, engine and boiler tests, inclining experiments, and launchings, all of which have been of the greatest benefit to them.

The department has recently moved into an exceptionally fine building of its own, due to the generosity of the late Charles Herbert Pratt who bequeathed the major portion of his estate to the institute for the purpose of providing a building for the Pratt School of naval architecture and marine engineering.

The course in naval architecture at the Institute has never had the advantage of being equipped with a

model tank, but at the present time studies are being made to obtain the data necessary for designing one. It is hoped that its design and construction may be undertaken during the coming year. Reference to the many valuable papers read before the Society of Naval Architects and Marine Engineers by Prof. H. C. Sadler of the University of Michigan will give an idea of the benefit which a course in naval architecture may derive from having a model basin as part of its own equipment.

Even a casual reading of the preceding paragraphs describing the course at the Institute of Technology will show that technical education

technical education such as that offered in naval architecture by the institute, the University of Michigan and Webb academy, provide a broad training which is extremely useful to an executive. Shipbuilding needs all-around men, because of the great variety of interests called for in this work. Each of these interests requires the services of those skilled in their trades and professions. Education in the fundamentals of engineering and in the principles of business is therefore sure to exert important influence.

It is hoped that in the future also, the man who has taken a course in engineering will aspire to a larger share in the administration of the

gree of bachelor of science. The number of graduates in naval architecture from the institutions in this country is not known to the author, but it must be considerable, and it is apparent that their education in naval architecture and marine engineering is certain to have an increasingly important influence upon the shipbuilding and shipping industries in this country as time goes on.

Under the provisions of the Jones-White bill just passed by congress it would seem, however, that the present outlook in the shipbuilding industry in this country is more encouraging. It is sincerely hoped that this will prove true. The United



A Drafting Room of the Department of Naval Architecture, Massachusetts Institute of Technology

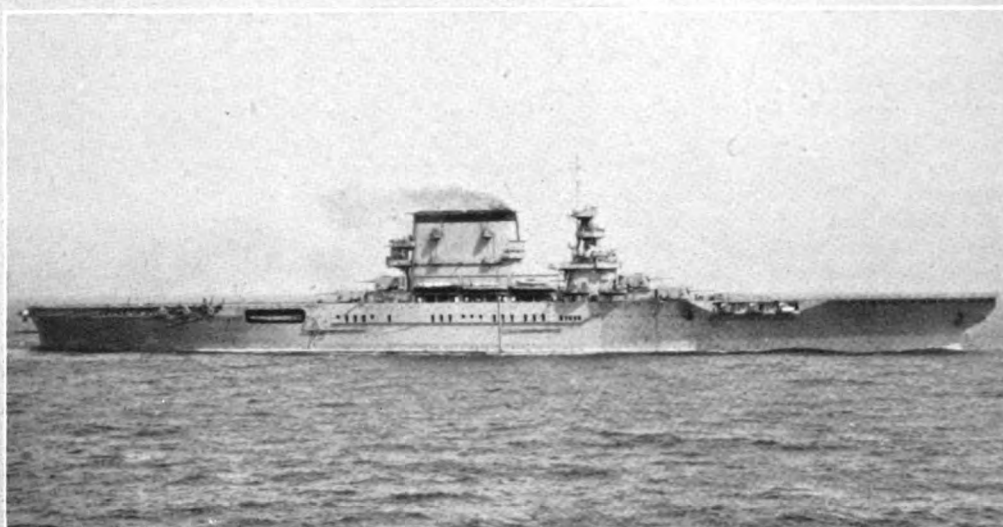
must have exerted a marked influence upon naval architecture and marine engineering in the past, and will continue to do so more and more in the future. Lists of subjects required of students are uninteresting reading, but they serve to show the items now considered important in the technical education of a shipbuilder, or of a ship operator, and indirectly tell us the influence of such an education upon naval architecture and marine engineering. In other words, a man who has studied all these various subjects will have not only a fund of remarkably useful information, but he will bring into his work the habits of trained thinking and of systematic handling of the problems which are presented to him. Furthermore, a

large industrial enterprises, and especially in shipbuilding.

A survey of the men now prominent in the shipbuilding industry in this country will show that most of them have had an engineering education. In naval work such an education is absolutely necessary, and the course in naval construction at the Naval academy and at the institute of Technology was established with this requirement in mind. Since the course in naval construction was established at the Institute in 1901, 172 members of the construction corps of the United States navy have been graduated with the degree of master of science, and 334 men have graduated from the regular course in naval architecture receiving its de-

States has already dropped to an extremely low position in the world's shipbuilding, and even a brief study of our maritime history will show that merchant ships as well as warships are a vital factor in our national security and defense.

The time and effort necessary for even an understanding of the principles covered by the courses at Technology is very considerable. In a national crisis no similar amount of time and effort can be spared, consequently it is extremely important for us all to realize the tremendous influence that education is sure to have in the shipbuilding of the future and to prepare and to exert our efforts toward making that education the best possible.



U. S. S. SARATOGA—AIRCRAFT CARRIER—33,000 TONS—1927

ARMAMENT
8—8 inch Guns
12—5 inch, 45 Cal. A. A.

SPEED and POWER
33 Knots
180,000 Shaft Horsepower

Naval Problems Help to Develop Merchant Design and Personnel

By Herbert R. Simonds

IN AMERICA the navy's value as proving ground for new schemes has been impressive because of the slow development of the merchant marine. In England it was a private shipyard which first developed a model basin. Here it was the navy. Similarly private interests first adopted the marine turbine in England, and in this country, although the General Electric Co. did a vast amount of development work, it was the navy which took the initial step in practical application.

The desire for greater and greater speed has ever been a prime motive in ship design just as it has been in automobile design, and now is in airplane design.

The British, although admitting temporary defeat at the hands of the packets, did not sit idly by. Instead they went very much to work. They encouraged experimental work with steam engines and studied designs of all manner of hulls. In 1839 they awarded an Atlantic mail contract with an annual subsidy of \$425,000, to Samuel Cunard and

thereby created the most famous of the Atlantic steamship companies. The first ships of this line were mere wooden-hulled side-wheelers which thrashed along at ten knots speed and crossed the Atlantic in fourteen to seventeen days. This however was faster than the average of the packets and effectively served to arrest the astonishing rise in popularity of American ships. Previous to England's steam vessel venture, there was no doubt in the minds of the shrewdest merchants and owners and builders that Great Britain would soon cease to be the mistress of the seas and must content herself with second place. In the short space of four years this sentiment changed. New and large steamers were built at Liverpool and steam ceased to be an experiment.

Any account of the development of the United States navy must include the historic encounter of the first ironclads, the MONITOR and the MERIMAC. This encounter revolutionized the navies of the world and showed that wooden ships, which had long

held control of the ocean were of no further use for fighting purposes.

For a brief period at the end of the Civil war the monitors with their Dahlgren guns made the American navy the most powerful in the world but almost no further attention was given it, and ten years later it was the symbol of inefficiency and decay among the seamen of the world.

It was not until the "White Squadron" was started under the energetic direction of Secretary Whitney that the navy showed any signs of recovery. From 1885 to 1895 was a period of intense naval activity in this country. Whitney demonstrated that we had to build steel mills before we could build modern battle-ships and thus demonstrated at the same time the complete interdependence of industry and navy. Without the urgent need for steel for armor our steel making facilities would have developed much more slowly and our industrial progress would have been slowed down by an amount difficult to exaggerate. In 1887 a contract was placed with the Bethlehem Iron

Co. for armor steel and gun forgings of a character never before attempted in this country. Thus were forging methods originated for later use in private enterprise.

By the time of the Spanish American war our navy was again in fairly good shape, although struggling under meager appropriations. The successes of that war, however, gave the navy a tremendous impetus which has since placed the United States again in the front rank among naval powers of the world. The invention of the wireless received its first demonstration of practical value in the navy. Then came the Parsons and Curtis turbines. The General Electric Co. worked for many years perfecting the electric drive for ships and finally persuaded the navy to try this in the JUPITER. The NEW MEXICO, built in 1918 was the first battleship to use electricity exclusively as a driving power. Now seven of our first line battleships are electrically driven.

Navy Adopts Electric Drive

Perhaps no single instance better illustrates the use of the navy as a national laboratory for the benefit of the merchant marine and of land industry than this early proving out of electric drive on a large scale.

As a result of the navy's experimental work our merchant marine has been justified in turning to electric drive many years earlier than it otherwise could have done. Our largest American built merchant ship—the CALIFORNIA—is an example. Her

power plant is a modern full electric drive of a design based on naval experience.

Besides acting as a laboratory for the trying out of new designs and

nor merchant marine of any significance. In England at this time a flourishing merchant marine was developing leadership in designing and was contributing much to its navy in this direction.

The Navy's Trained Designers

The American navy, while ahead of our merchant service in starting general recovery, was slow to develop its designing personnel. As late as 1896 the development of naval architecture in this country was so backward that it was necessary to send Annapolis graduates abroad to complete their studies in this field. The first floating dock put into service in this country was built from plans purchased from Clark & Stanschfield, London. This dock is still in existence and is now in the New Orleans harbor. The old battleship TEXAS, built about 1895, was one of the finest vessels afloat, but even in her case it was necessary to go abroad to purchase the plans.

Recovery from this designing lethargy started with Whitney and the "White Squadron" despite the fact that most of the men who worked on the design of these ships were graduates of the University of Glasgow and the University of Paris. In 1896 the Massachusetts Institute of Technology started a course in naval architecture and marine engineering.

A number of private shipyards have been started by naval engineers, and many have drawn their designing personnel from the navy. The Newport News Shipbuilding and Dry Dock Co.

Battleship Development in United States

Year	Displacement	Length	Speed
1911	21,825	521	22.08
1912	26,000	562	21.05
1914	27,000	573	21.00
1916	31,400	608	21.00
1917	32,000	624	21.00
1918	32,000	624	21.00
1919	32,000	624	21.29
1920	32,300	624	21.00
1921	32,600	624	21.76
1923	32,600	624	21.00

United States Population Increase

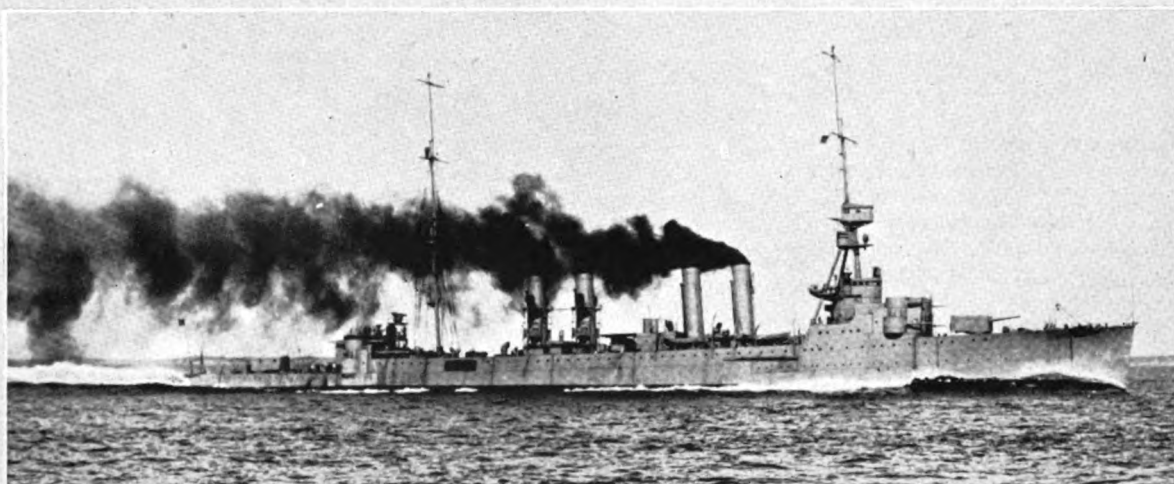
1880	50,155,000
1890	62,947,000
1900	75,994,000
1910	91,972,000
1920	105,710,000
1925	113,493,000

Naval Expenditure

1885-1890	\$ 2,794,000
1890-1895	\$ 9,580,000
1895-1900	\$ 12,217,000
1900-1905	\$ 17,781,000
1905-1910	\$ 25,295,000
1910-1915	\$ 23,992,000
1915-1923	\$208,329,000

inventions, the navy has been a laboratory for the development of designers.

Just as a navy helps a country's private shipping, so does a vigorous, growing merchant marine help a navy. Some years after the Civil war, this country was particularly unfortunate in having neither a navy



U. S. S. RICHMOND—LIGHT CRUISER—7500 TONS—YEAR 1923

COMPLEMENT

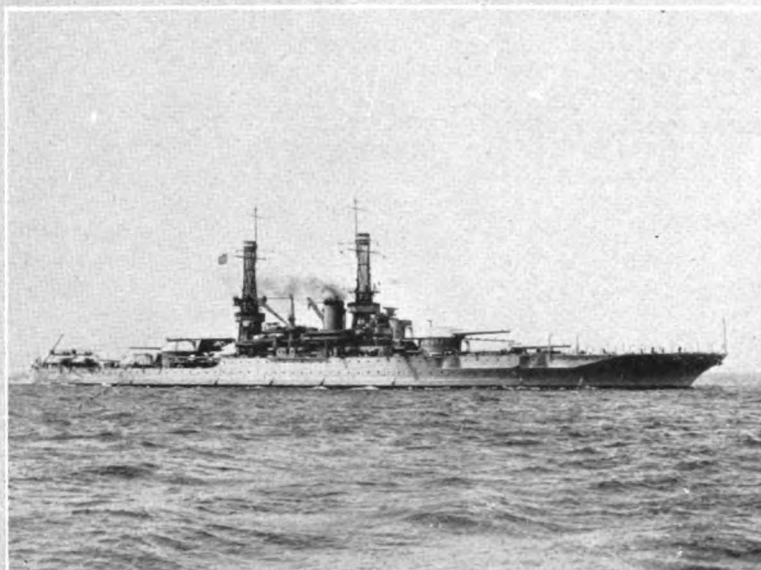
29 Officers
429 Men

ARMAMENT

12—6 inch, 53 Cal.
4—3 inch, 50 Cal., A. A.
4—21 inch Torp. Tubes

SPEED and POWER

34.2 Knots
92,772 Shaft Horsepower



U. S. S. MISSISSIPPI — BATTLESHIP — 32,000 TONS — YEAR 1917
 ARMAMENT 12—14 inch, 12 inch 8—3 inch Guns
 COMPLEMENT 67 Officers 1307 Men
 SPEED and POWER 21.09 Knots 31,864 Shaft Horsepower

no good designer would think of building a new type of ship without having its model proved at Washington.

Navy Is Pioneer in Speed

Of course for a naval ship the weight of armor and ordnance has to be considered. A battleship is at best a compromise between speed, cruising radius and armor and guns. Improvements in steel and steel alloys have contributed much to all three of these main features. Higher strength of steel has meant lower weight of power plant for the same horsepower and this has meant more room for fuel and more weight to spare for armor and guns. Also high strength steel has resulted in lighter weight guns for same effectiveness and lighter armor for same resistance to penetration.

One of the outstanding differences between the merchant and the naval ship is that the merchant ship must earn a profit. Any new feature which does not in some way contribute to this end is unwarranted. For this reason speed in the merchant marine has been sacrificed to economy and it has remained for the navy to pioneer in the field of rapid travel.

When private interests recently proposed a line of four-day ships to operate between England and America, they pointed to accomplishments of the navy for confirmation of the practicality of the speed required. The naval designers drawing freely upon the latest scientific developments in industry, have succeeded in pushing great armored hulls through the water at forty miles an

is headed by an ex-naval constructor, Homer L. Ferguson. Holden Evans, an ex-naval constructor, headed the Baltimore Dry Dock Co. Another ex-navy man, Joseph W. Powell was prominent in the reorganization of the Fore River shipyards. When the

In the last few years the private marine interests appear to have awakened to the need of training young men as ship designers, and as these interests pay more money we may expect to see a moderate decline in the navy's designing prestige.

One of the chief exponents of civilian designing interests is Prof. H. C. Sadler at the University of Michigan, who has carried out many tests in the university's model basin for merchant ships of all types.

Experimental Model Basin

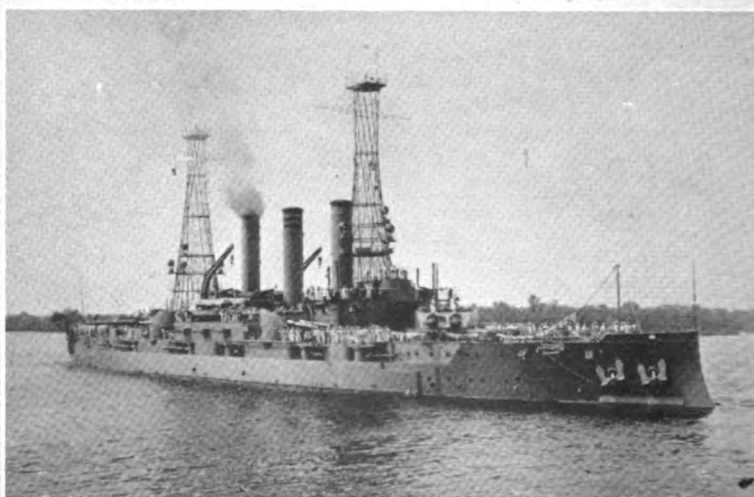
The first model basin for experimental research in design of ships was built by William Froude at Torquay, Devonshire, Eng., about 1875. Compared with modern basins this was a crude affair, but with it Froude was able to work out some formulas and basic principles of design which are still in use.

In 1883 a private model basin was built on the Clyde in England. Our own model basin at Washington, which is one of the most completely equipped in the world, was built in 1898 under the direction of Admiral, then Commander, D. W. Taylor of the construction corps of the United States navy. It consists of a rectangular tank 450 feet long and about 45 feet wide. The width is spanned by a travelling carriage or

platform from which the models are towed and the resistance at different speeds measured. The models used are about twenty feet long and are carefully constructed from the designs which later will be used for the full sized ships. Arrangements are also worked out for self-propelled model tests.

The basin, while primarily built for the navy, is open to private individuals and has been used with excellent results in the design of nearly all important merchant ships built in the last quarter century.

This basin is now so much a part of the ship building industry that



U. S. S. KANSAS—BATTLESHIP—16,000 TONS—YEAR 1907
 COMPLEMENT 49 Officers 906 Men
 ARMAMENT 4—12, 8—8, 12—7 in. 20—3 inch Guns 4—21 inch Torp. Tubes
 SPEED and POWER 18.09 Knots 19,757 Shaft Horsepower

hour or more. For such feats tremendous horsepower has been required.

The airplane carrier, LEXINGTON, weighing 33,000 tons, requires 180,000 horsepower to push her through the water at a speed of 33 knots, while lighter ships, with proportionately larger power plants, are successfully developing higher speeds. This vessel recently made a trip of about 700 nautical miles at an average rate of 29 knots.

Navy Develops Various Alloys

In an encounter in wartime each knot, each inch of armor, and each additional gun, may be the deciding factor. It is like a tug of war.

Because of the difficulty of surpassing one another in general design, the contest has been carried to materials and to new scientific achievement. It has thus passed to a considerable extent from the navy to industry. In each country back of each navy, metallurgists are at work trying to produce lighter and stronger materials and engineers are struggling to develop prime movers with greater horsepower per ton of weight. Here again we have interdependence of navy and industry. If alloy armor plate is produced which will have equal penetration resistance and less weight, it, for a while at least, will give the country of its production an advantage in naval construction. But such a new alloy, should it be produced, would undoubtedly be a boon to industry as well. The stimulus of the naval need already has resulted in many new materials and machines of value to manufacturers.

When submarines were first pro-

posed the stumbling block was the motive power. What could be used which could be shut off instantly at submerging and yet which would not have objectionable fumes whether idle or operating? The high pressure oil engine was the answer and so important has this been in underwater design that one might almost say the diesel engine has made the submarine. Conversely the submarine has been responsible for the development of the diesel engine to its present efficiency.

Unquestionably one of the important results of the World war was its demonstration of the intimate relationship of a merchant marine and

a fighting navy. One of its lesser results, however, was the saddling of our merchant marine with a lot of hastily built wartime merchant ships and a vast excess in shipyard capacity.

These two burdens coming at once nearly brought disaster and the resultant decline in merchant marine activity since 1920 has been serious.

Alfred H. Haag of Georgetown university in an analysis of this situation, gives the following table showing the number of vessels built or building during the past five years.

Country	No. Naval		No. Merchant	
	Vessels	Tons	Vessels	Tons
United States..	19	150,909	18	199,884
British Empire	37	285,795	741	4,588,847
Japan	101	339,201	71	350,556
France	96	221,828	80	507,556
Italy	46	102,207	91	805,945
Germany			221	1,348,533

This is a startling revelation to most Americans who have felt that the United States merchant marine was well launched on an ambitious program of expansion. Mr. Haag says, "The erroneous idea prevails that America during the war period built a huge merchant marine for the purpose of competing in world trade routes. Such was not the case. We built ships and shipbuilding plants for the sole purpose of creating a 'bridge of ships' to Europe with no thought of world competition thereafter. The amounts spent should be classed as war expenditure in the same sense as ammunition used at the front."

Of all merchant vessels of 2000 tons and over built since the war, Great Britain has built forty-two to every single ship built by United States.



U. S. S. MINNEAPOLIS—PROTECTED CRUISER—7350 TONS—YEAR 1894
 ARMAMENT 3—6, 8—4 inch Guns 12—6 pounders
 COMPLEMENT 18 Officers 360 Men
 SPEED and POWER 23.07 Knots 20,862 Horsepower



U. S. S. ATLANTA—PROTECTED CRUISER—3000 TONS—YEAR 1885
 ARMAMENT 2—8, 3—6, 1—4 inch 6—6 pounders
 COMPLEMENT 18 Officers 285 Men
 SPEED and POWER 15.6 Knots 7500 Horsepower



Section of Locust Point, Baltimore, Marine Terminal—1878

Famous Ports of America Show Remarkable Development

By Roy S. Mac Elwee, Ph. D.

PERHAPS no other phase of American life shows such striking changes and advancements as the traffic and equipment of leading American seaports. It is therefore opportune and of special interest that *MARINE REVIEW* on its fiftieth anniversary should consider a few examples illustrative of this growth. It is obviously impossible to show more than a few of the seaports of the country. The two accompanying tables of comparative figures for foreign commerce for the three years 1849, 1876 and 1926 are in themselves striking illustrations of our commercial growth. In considering the value statistics it must be remembered that the purchasing power of the dollar today is not what it was

in 1849 or 1876, being much less.

Active port development, along comprehensive plans, by cities and states began about 1900. Such plans affected an entire port area and were carried forward for the benefit of all. The increased size of ships and increased volume of foreign commerce made new port facilities necessary and port construction in the United States beginning with the World war has been very active during the last decade. The greatest new development in American shipping and American ports has been, since the World war, through the Panama canal. The inter-coastal business has developed to enormous proportions and it is decidedly long sea voyage commerce. The vessels engaged in it are large cargo liners. Constructive improvements in terminal facilities and channels have been made to suit these large ocean going vessels.

Beginning at the North Atlantic we will discuss briefly the ports of Bos-

ton, New York, Philadelphia, Baltimore, Norfolk, Charleston, Mobile, New Orleans and San Francisco.

Port of Boston

IMPORTS at Boston during the year ending June 30, 1878, were valued at \$40,679,714 and exports at \$48,121,119 while in the calendar year 1927 the imports were valued at \$261,573,994 and the exports at \$42,435,418. Intercoastal shipping is becoming a great factor in the port's business. In 1927, 522,976 long tons of merchandise were received from the Pacific coast. The shipments to the West coast for the same year amounted to 102,873 tons.

Great improvements have been made by dredging and widening the channels of and the rivers contiguous to the harbor. President Roads channel has a depth of 35 feet at mean low water and a width of 1200 feet. A new channel, the Broad Sound channel, has been dredged to give a

The author, Dr. Roy S. Mac Elwee, is commissioner of port development for Charleston, S. C. He is author of *Ports and Terminal Facilities*, *Port Development*, *Wharf Management*, (with Taylor), *Economic Aspects of the Great Lakes Ship Channel* (with Ritter), etc. This article was prepared at the request of the editor.

depth of 40 feet at mean low water from President roads to Graves light, and 1500 feet wide. At high tide this channel is deeper than that of any other port on the Atlantic seaboard. The harbor has an area of 47 square miles and is only six miles to the open sea. It is from 200 to 400 miles nearer Europe than any other North Atlantic port.

Terminal facilities of the port have been increased and improved during recent years. Berthing space is provided for 60 ocean steamers at one time. Among the modern terminals are the army base accommodating nine steamers, and equipped with modern equipment for rapid cargo handling; Commonwealth pier 5, accommodating five large ocean steamers; Boston fish pier, largest terminal for handling fish in the world; and the Wiggim lumber terminal. The railroads entering Boston also own modern piers splendidly equipped. The port of Boston has the largest drydock in the United States. Built by the state, known as the Commonwealth dock and now owned and operated by the United States navy it is the only dry dock on the Atlantic seaboard capable of taking the LEVIATHAN and MAJESTIC. Much good work has been done for the port by the maritime association of the chamber of commerce under the management of Frank S. Davis.

Port of New York

THE port of New York has become the most important port of the world. Facilities were first improved extensively as public wharves under General McClellan in the early seventies. This elaborate improvement, made before the era of great increase in ship dimensions, soon became obsolete and these early piers have since become a great handicap. The city has continued to build new modern 1000-foot piers at great expense by tearing out the old ones and blasting into the rocky shores in order to get sufficient length between pierhead line and the bulkhead line. Piers Nos. 84 and 86 are recent examples of what New York is doing.

The states of New York and New Jersey jointly created the Port of New York authority. This body has worked with great energy along well-laid out lines on a comprehensive plan of port development. Private enterprises such as the New York Dock Co., Bush Terminal Co. and a number of steamship lines have also materially added to the facilities of the port.

Channels entering New York have received constant attention by the government. Within the last few years

the great Ambrose channel, over 2000 feet wide and 40 feet deep at low tide has been completed to give a direct and short entrance to the port for the largest vessels. Work is also being done in removing reefs in the East river, or so-called back door entrance to New York through Hell gate, so that large commercial and naval vessels may safely pass.

The total commerce of the port of New York in 1926 was greater than the entire foreign commerce of the whole United States in 1914. Growth of commerce at the port is in excess of the facilities to handle it and plans are now under way to remove miles of old Manhattan piers and to replace them with modern ones. New York is the center of the coastwise and intercoastal shipping because it is the greatest producing and consuming area in the whole world. Over 10,000 people producing over 10 per cent of the total value of manufactured products of the United States live in the metropolitan area. New York will

continue to grow, there is every reason to believe.

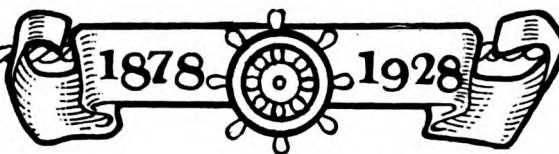
Port of Philadelphia

PHILADELPHIA is one of the historic ports of colonial days and has been an important factor for generations in the commerce of the country. Although over 100 miles from the sea the government has continuously increased the depth and width of the channel and it is now 600 feet wide and 35 feet deep to the terminals. Because of the importance of the navy yard and the area served by the Delaware river and the cities of Philadelphia, Chester and Wilmington the channel depth will undoubtedly be increased as necessary as the demands of shipping appear.

Philadelphia is an outstanding example of municipal enterprise in port development. Many millions of dollars have been spent by the city in the construction of modern piers. During the World war the government built an elaborate army supply base.



San Francisco Wharf About 1870



Improve American Port Facilities

Below—Army Base at Norfolk, Va.—This terminal was constructed as a war supply base and has an area of 3,000,000 square feet



Above—Charleston, S. C., Navy day, 1927—U. S. S. ARKANSAS at dock of the Union pier—U. S. S. FLORIDA in stream—forty destroyers, cruisers, tenders and battleships were in port



Above—Busy day in the port of Baltimore—Locust point marine terminal, Baltimore and Ohio railroad

Right—Along the Embarcadero, San Francisco's famous waterfront, piers 29 and 31

Below—Lumber in storage under steel sheds of public wharves at New Orleans



Below—Boston harbor, 1928—The natural advantages of this harbor are superb

Photo by Fairchild Aerial Surveys Inc.



Left—A typical New Orleans wharf scene in 1900 before the construction of public shedded wharves—These wharves extended for seven miles as open quays—Now all rebuilt, many under steel sheds

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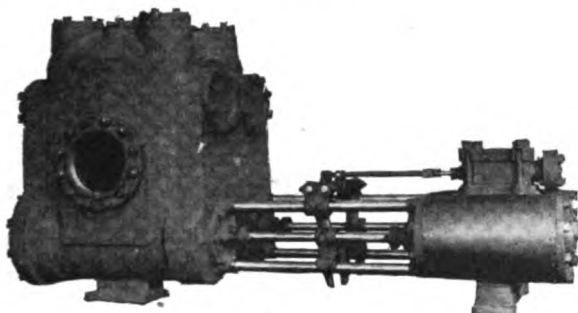


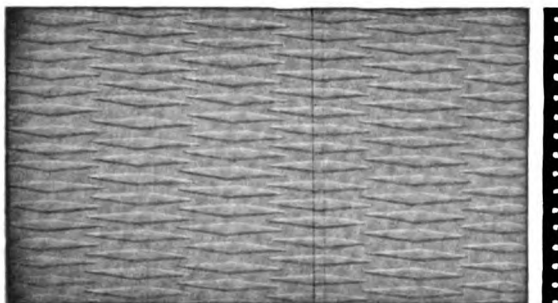
Figure No. 1518 Horizontal Durable
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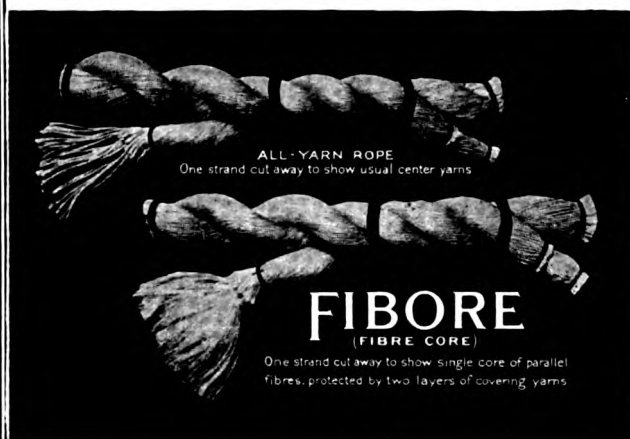


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Reviews of Late Books

Seaways and Sea Trade, by A. C. Hardy; cloth, 229 pages, 6 by 9½ inches; published by D. Van Nostrand Co., New York, and furnished by MARINE REVIEW, Cleveland, for \$6.00 postpaid, and in Europe by the Penton Publishing Co., Ltd., Caxton House, London, for 25 shillings.

A. C. Hardy, the author of this book, has set forth a great amount of information which has particular application to the economic question of carrying goods and people by water. With clarity and straightforwardness, he has developed the subject of waterways as regards not only the sea, but lakes, rivers, and canals as well. This knowledge could come only from close association with, and careful study of the subject of ways and trade of the sea. For those who would make a study of the evolution of maritime trade, and of the chief commodities associated with that trade, the book is of great value.

The question of oil and its economic application, which by the way, is assuming greater importance perhaps than any other subject in the marine field—is one which very notably deserves mention the discussion of a topic of the significance of seaways and sea trade. The enormous advantages which may be gained through using oil-propelled vessels must have great weight in regard to future developments. This subject has been fairly and interestingly discussed by the author.

Importance of the Great Lakes, as inland waterways carrying bulk freight in excess of that transported by any other carrier receives the emphasis and interpretation which it most obviously deserves. Regarding passenger transportation, including that of emigrant and tourist, the book points out the fact that passenger, emigrant and tourist, each forms a very definite trade. The outstanding feature of the book, and incidentally the one which makes it unique, is the fact that it describes trade routes and cargoes carried through the liberal and illustrative use of maps. Present day ships and the particular fitness of one type to its own distinct purpose is another of the many important subjects treated interestingly and fully by the author. The types and function of ports, the geographical and economic reasons for their locations and the consequent influence which they have on maritime inter-

ests is a subject of broad application competently developed in this book.

* * *

Steamboat Inspection Service—Its History, Activities and Organization, by Lloyd M. Short, cloth, 127 pages, 5½ by 8½ inches, published by the Johns Hopkins Press, Baltimore, and furnished by MARINE REVIEW, Cleveland, for \$1.00 postpaid and in Europe by the Penton Publishing Co., Ltd., Caxton House, London, for 5 shillings.

This book is called a service monograph of the United States government, No. 8. It was prepared at the instance of the institute for government research, an association of citizens for co-operating with public officials in the scientific study of government, with a view to promoting efficiency and economy in its operation and advancing the science of administration.

This monograph, like the others, follows a uniform plan in giving a history of the establishment and development of the steamboat inspection service. It describes in detail its specific activities and its organization for the handling of these activities. The character of equipment and a compilation of the laws and regulations governing its operation are also given. Mention is made of the appropriations and expenditures and other data over a period of years. Finally a full bibliography is given of the sources of information, official and private, which bears on the service and its operation.

To the public this monograph gives that specific knowledge of the organization and operation of the steamboat inspection service which is necessary if constructive criticism is to be possible. Before criticising our steamboat inspection service it would be the part of good policy to thoroughly read this valuable book.

* * *

The Hydrographic Office, by Gustavus A. Weber, cloth, 102 pages, 5½ by 8½ inches, published by the Johns Hopkins Press, Baltimore, and furnished by MARINE REVIEW, Cleveland, for \$1.00 postpaid and in Europe by the Penton Publishing Co., Ltd., Caxton House, London, for five shillings.

This book, a service monograph of the United States government, follows the general policy of the series: The dissemination of knowledge among the people in order that they may know something of the organization

and operation of government. In the opening chapter of the monograph, the functions of the office, which came as answer to a very definite need, are outlined. A history of its founding and subsequent development into a definite department of government is included. The activities are described in detail. Extracts from the naval regulations and the bureau of navigation manual, define fully the duties of the bureau of navigation, of the hydrographic office, and of naval officers with regard to hydrographic observations and reports. The particular relation of the hydrographic to the naval department is clearly brought out and the importance of its function stressed. The organization is fully described and a complete outline of it may be found in the appendix.

By reading this monograph, one gains a very clear conception of the purpose and function of this office, and realizes that in all respects the treatment is complete and informative.

* * *

The Abrasive Handbook, by Fred B. Jacobs, cloth 560 pages, 6 x 9 inches, published by the Penton Publishing Co., Cleveland, furnished by MARINE REVIEW for \$5 and in Europe by the Penton Publishing Co. Ltd., Caxton House, London, for 25s.

The entire abrasive industry represents a slow development of some 30 years followed by more rapid progress during the past 20 years. With the steady advancement of the industry, rule-of-thumb methods gradually were replaced by scientific practices so that today the industry is a recognized branch of modern engineering.

While much has been written in times past pertaining to abrasives and abrasive machinery, the industry has been without a handbook. To be sure engineering handbooks furnish a few scant pages wherein certain fundamental principles are given, but when the abrasive engineer, superintendent, grinding room foreman, or grinding room machine operator desires information on specific subjects he is confronted with the problem of making an extensive research through endless back files of technical magazines and often without satisfactory results.

This prompted Mr. Jacobs, who is the editor of *Abrasive Industry*, some 15 years ago to begin the compilation of abrasive data. Various items pertaining to abrasive practice were collected, filed, and indexed. As a reference work for works managers, chief engineers, designers, abrasive engineers, grinding room foremen, and grinding machine operators, this book will be found of real merit and value.

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Late Flashes On Marine Disasters

Brief Summaries of Recent Maritime Casualties—
A Record of Collisions, Wrecks, Fires and Losses

NAME	DATE	NATURE	PLACE	DAMAGE RESULTING	NAME	DATE	NATURE	PLACE	DAMAGE RESULTING
American Trader	Jan. 15	Collision	Gravesend	Port bow	Mytilus	Jan. 22	Collision	Penn City	Considerable
Alexis I. Dupont	Jan. 27	Sank	Nr. Cape Lookout	Not stated	Mary	Dec. 29	Sank	Liverpool	Floated—
Albert E. Watts	Jan. 22	Collision	Penn City	Considerable	Mondara	Dec. 29	Aground	Strangford Lough	propeller
Amerique	Jan. 20	Stranded	Pointe Camoens	Not stated	Medway	Jan. 2	Collision	Blackwall	Rudder
Admiral Sebree	Jan. 30	Disabled	Seattle	Propeller	Manchester Spinner	Jan. 30	Collision	Bolivar Roads	Stem
Abundance	Jan. 31	Gale	Turks Island	Damaged	Meton	Feb. 1	Aground	Long Beach	Floated
Antiochia	Jan. 2	Collision	Antwerp Roads	Considerable	Munalbro	Feb. 1	Aground	Cayo Piedra	Not stated
Alto Parana	Jan. 24	Sank	Nr. Asuncion	Not stated	Maurice E. Connolly	Feb. 9	Collision	Nr. Clason Pt.	Damaged
Almirante Grau	Jan. 26	Collision	Off Balboa	Damaged	Mineola	Jan. 5	Ashore	Old Prov. Isle	No. 1 hold
Alsacien	Jan. 26	Collision	North Foreland	Not stated	Memore	Jan. 11	Fire	Genoa	Dec; life- boats
Anaconda	Feb. 10	Collision	Off Hoboken	Not stated	Maasdam	Jan. 18	Collision	Antwerp	Not stated
Brodsworth	Jan. 5	Collision	Rotterdam	Damaged	Munin	Jan. 18	Aground	Sangomar	Floated
British Viscount	Jan. 13	Fire	North Shields	Not stated	Matheran	Jan. 20	Collision	Middlesbrough	Damaged
Brandon	Jan. 18	Fire	St. John, N. B.	Not stated	Mungret	Jan. 19	Ashore	Crookhaven	Floated — rudderpost
Belmont	Jan. 26	Stranded	Peterhead Harbour	Bottom	Molly	Jan. 22	Sank	Plumstead	Raised
Bunkering I	Jan. 26	Explosion	Antwerp	Badly	Marie Sprenger	Jan. 24	Collision	Grimsby	Not stated
City of Glasgow	Jan. 20	Collision	Off Jersey Coast	Considerable	Magdala	Jan. 26	Disabled	53-11N. 16W	Steering
Cyclamen	Dec. 24	Ashore on rocks	Beninguet	Considerable	Mao III	Feb. 9	Ashore	Peaked Hill	gear
Chickasaw	Jan. 31	Aground	Boston	Floated	Mattawa	Feb. 8	Explosion	Reef Island	Total loss
Clan Skene	Feb. 3	Disabled	Colombo	Machinery	Noyo	Jan. 15	Disabled	San Francisco	Propeller; steering gear
Cassimir	Feb. 8	Aground	Hollands Points	Floated	Nassau	Jan. 26	Collision	Brooklyn	Damaged
Castelnau	Jan. 13	Ashore	Off Fecamp	Not stated	Nelly	Dec. 26	Aground	Cowden	Not stated
Chilton	Jan. 13	Collision	Newcastle	Not stated	Nistru	Jan. 4	Stranded	Baltchik	Not stated
Corcest	Jan. 13	Collision	Whitehill Point	Not stated	Nordvard	Feb. 2	Collision	Hoboken	Side
Cabo Santa Maria	Jan. 18	Aground	Seville	Not stated	No. 59-A	Feb. 9	Collision	Nr. Clason Point	Damaged
Cewea	Jan. 19	Ashore	Nr. Palling	Not stated	Norwich Trader	Jan. 18	Collision	Great Yarmouth	Not stated
Clan Buchanan	Jan. 20	Collision	Middlesbrough	Not stated	Nestum	Jan. 19	Collision	Cadishhead	Bow
Carlsten	Jan. 23	Collision	Hook of Holland	Not stated	Otterhound	Dec. 30	Collided pier-head	Preston	Bows
Cape Town Maru	Jan. 23	Collision	Hook of Holland	Port side	Ophir	Jan. 16	Aground	Aalesund	Floated — forepeak
Creek Fisher	Jan. 23	Disabled	Plymouth	Machinery	Ocean II	Jan. 24	Collision	Grimsby	Below water-line
Caliph	Jan. 26	Stranded	Hellick Head	Floated— rudder	Peaceland	Jan. 13	Collision	Yarmouth	Damaged
Clairton	Feb. 10	Collision	Off Hoboken	Damaged	Pologne	Jan. 1	Struck break-water	Gdynia	Stem
Driebergen	Jan. 19	Aground	Houston Channel	Not stated	Pat Doheny	Feb. 4	Disabled	Panama	Engines
Dainichizan Maru	Dec. 28	Stranded	Nr. Otaru	Total loss	Pallas	Jan. 22	Aground	Ulvengen	Not stated
Dustin G. Cressy	Jan. 28	Aground	Nr. Newark	Floated	Pionier	Jan. 25	Collision	Rosario	Stern; main deck
Devon City	Jan. 31	Aground	Off Muroran	Not stated	Paul Howard	Jan. 26	Collision	Norfolk	Damaged
Dimitris	Jan. 18	Collision	Buenos Ayres	Bow plates	Queens County	Jan. 19	Struck ledge	Halifax	Stem; plate
Dotterel	Jan. 19	Collision	Cadishhead	Stem; bow	Rama	Jan. 16	Collision	New Orleans	Slight
El Alba	Jan. 19	Aground	Houston Channel	Not stated	Restless	Jan. 19	Ashore	Off Fort Phenix	Not stated
Elbecktal	Jan. 18	Ashore	Greenhithe	Floated	Roana	Jan. 22	Aground	Bermuda	Floated — bottom
Elberfeld	Jan. 20	Stranded	Nr. Trafalgar	Total loss	Rossmore	Jan. 3	Collision	Barry Roads	Not stated
Fernlane-Hofuku Maru	Jan. 15	Collision	Tacoma	Damaged	Richard C. Krogmann	Jan. 5	Ashore	Reykjavik	Starboard side
Flint	Jan. 5	Aground	Nr. Hansweerd	Not stated	San Pablo	Jan. 14	Fire	Kingston	Not stated
Ferento	Jan. 4	Collision	Nr. Gluckstadt	Starboard bow	Sunewco	Jan. 19	Aground	Lake Union	Floated
Freighter	Jan. 18	Collision	Great Yarmouth	Plate; belt-ing	Santa Fulalia	Jan. 29	Disabled	San Francisco	Steering gear
Fredheim	Jan. 25	Aground	Glasgow	Not stated	Shofuku Maru	Dec. 31	Stranded	Nr. Fumakawa Akita	Not stated
Gustav Vigeland	Jan. 16	Collision	Off Kaighns Pt.	Amidships	Senator Reymond	Dec. 24	Struck rocks	Cherbourg	Bow
Gallier	Jan. 4	Collision	Nr. Gluckstadt	Damaged	Silverlight	Jan. 3	Collision	Barry Roads	Not stated
Goodwill of Bristol	Jan. 6	Disabled	Falmouth	Steering gear	Sabotawan	Jan. 27	Disabled	London	Steering gear
Greysaint	Jan. 26	Aground	Egg Island	Floated— leaking; engines	Silverbrook	Feb. 4	Aground	Miami	Not stated
Hattie Thomas	Jan. 31	Sank	Elm Park	Raised	Spessart	Feb. 7	Collision	Charleston	Damaged
H. H. Rogers	Jan. 20	Aground	Houston	Floated	Salient	Jan. 16	Struck sbmgd. object	Buenos Ayres	Propeller
Hero	Jan. 5	Aground	River Weser	Floated — rudder	Salento	Jan. 15	Disabled	Mersey	Engine
Hurgerdijk	Jan. 20	Disabled	45N-41W	Rudder	S. A. H. O. P. No. 4	Jan. 18	Collision	Buenos Ayres	Forward
Hatching	Jan. 20	Collision	Woosung	Badly	Sweden Maru	Jan. 18	Aground	Malta	Floated — leaking
Harry A. Keeler	Jan. 25	Ashore	Newport	Damaged	Spider	Jan. 19	Ashore	Faxe Bay	Considerable
Indian Prince	Feb. 3	Aground	Rosario	Not stated	Stanhelm	Jan. 23	Collision	North Sea	Bows
Isis	Feb. 7	Aground	Bremen	Floated— engines; rudder	Starleyhall	Jan. 25	Collision	Blackwall Reach	Not stated
John McGuirl	Jan. 14	Fire	New York	Slight	St. Anthony	Jan. 26	Collision	Norfolk	Damaged
Jean	Jan. 15	Disabled	Off Brigantine Shoals	Not stated	S. N. A. 7	Jan. 25	Struck quay	Barry	Nos. 1 and 2 holds
Jamaica	Jan. 2	Ice	Vestervik	Rudder; rudder stock	Tela	Jan. 20	Collision	New York	Plate
Julius Wattering	Jan. 18	Aground	Narvik	Floated; leaking	Toba Maru	Jan. 21	Fire	Galveston	No. 1 hold
Jan Steens	Jan. 18	Collision	Antwerp	Amidships	Taisei Maru	Dec. 30	Aground	Baksha Point	Not stated
Jennie	Jan. 27	Aground	Liverpool	Badly	Torvanger	Jan. 30	Aground	Columbia River	Not stated
Kittery	Jan. 19	Aground	Nr. Indian Head	Not stated	Tiradentes	Jan. 25	Collision	Rosario	Not stated
Kwazan Maru	Dec. 31	Stranded	Nr. Keelung, Formosa	Not stated	Ursula Siemens	Jan. 17	Disabled	Liverpool	Propeller
Kayeson	Jan. 3	Aground	Pluckington Bank	Not stated	Victorious	Feb. 4	Disabled	Iloilo	Machinery
Klituno	Jan. 2	Gale; ashore	Nr. Sabla	Total loss	Vera	Jan. 16	Stranded	Hasle	Floated
Kolberg	Jan. 5	Aground	Esbjerg	Not stated	Varand	Jan. 26	Disabled	Off Queenstown	Rudder; propeller
Kennet	Jan. 26	Collision	London	Plates	Willkeno	Jan. 14	Aground	San Pedro	Damaged
Levisa	Jan. 16	Disabled	Boston	Machinery	William C. Atwater	Feb. 1	Gale struck pier	Searsport	Plates
Largo	Dec. 30	Collision	Ymuiden	Damaged	West Hobomac	Jan. 27	Fire	Galveston	No. 4 hold
Lady Ellen	Dec. 29	Collision	Faversham	Damaged	Willburg	Jan. 19	Collided wharf	San Francisco	Plates
Lornaeton	Jan. 30	Collision	Bolivar Roads	Plates	Wyncote	Jan. 19	Fire	Buenos Ayres	Not stated
Llantwit Major	Jan. 6	Struck quay	Roche Maurier	Plates; port quarter	Yankee	Jan. 24	Gale	Shelburne, N. S.	Leaking
Lythe	Jan. 6	Aground	Glasgow	Bottom	Yungay	Feb. 1	Ashore	Off Fleuthera IIs.	Total loss
Lithuania	Jan. 13	Collision	Whitehill Point	Not stated	Yarra	Jan. 22	Fire	Solomon Islands	Total loss
Liberal	Jan. 16	Struck wharf	Lorenzo Marques	Propeller					
Loyal	Jan. 19	Aground	Langesund	Not stated					
Loch Leven	Jan. 24	Ashore	Abarfraw	Floated					
Montgomery City	Jan. 18	Ashore	Charleston	Floated					
Maria De Larrinaga	Jan. 20	Disabled	49-48N-18-7 W	Steering gear					
Magna	Jan. 19	Ashore	Louisburg Harb.	Floated					



Marine Review

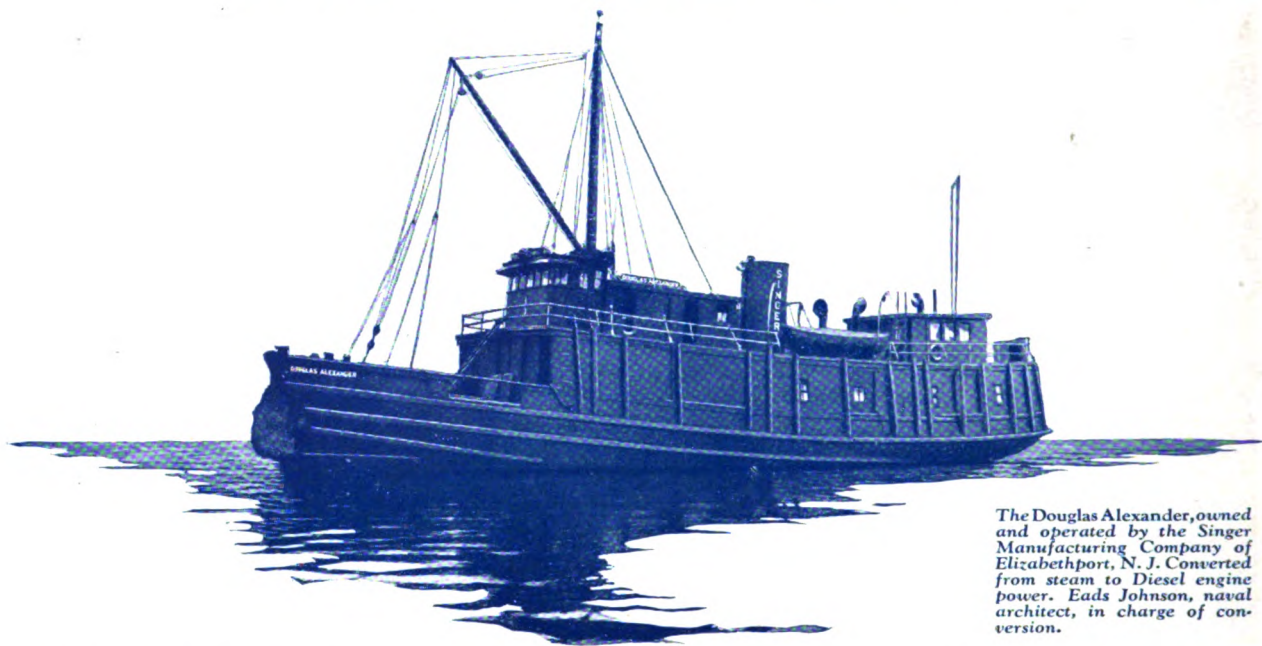
Reg.
U.S.
Pat.
Off.

July
1928

Fiftieth
Anniversary



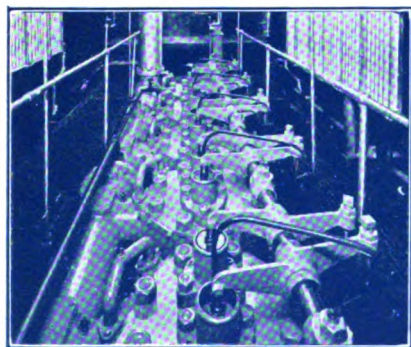
More cargo . . less fuel when NELSECO'S are used



The Douglas Alexander, owned and operated by the Singer Manufacturing Company of Elizabethport, N. J. Converted from steam to Diesel engine power. Eads Johnson, naval architect, in charge of conversion.

WHEN the Singer Manufacturing Company changed the lighter Douglas Alexander from steam to Nelseco Diesel propulsion, they made three big profits. In the first place, they

Engine room of the Douglas Alexander, showing installation of 6-cylinder, direct reversible, 500 brake horsepower Diesel engine.

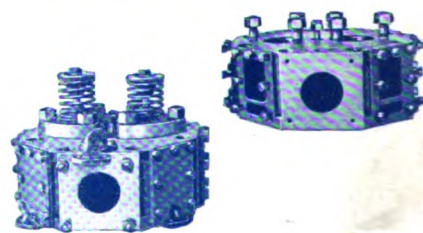


increased deck and cargo-space 25%. In the second place, they put in a far more economical power plant. And in addition, the increased power makes it possible to tow a fully loaded lighter alongside. The converted lighter will carry more freight at lower fuel cost—a triple saving on every trip!

The engine installed in the *Douglas Alexander* is a Nelseco 6-cylinder, direct reversible, 500 brake horsepower Diesel. Collaborating since 1910 with Maschinenfabrik - Augsburg - Nurnberg, A. G., (M. A. N.), the German marine engine organization in whose plant the first Diesels in the world were built, Nelseco has the benefit of a wealth of data and experience. The Nelseco engine of today embodies the most modern details of Diesel design.

Nelseco engineers will be glad to talk over your power problems with you. For full information on Nelseco Diesel engines, write for Catalog M. R.

Nelseco cylinder heads are equipped with a patented feature which directs the cooling water at high velocity first across the under side of the head, as this is the hottest surface, then at reduced velocity throughout the rest of the head. Removable cover plates on sides of the head allow easy inspection and cleaning, and insure accuracy in the location of core pieces in the foundry.



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America's Maritime Future Assured

By T. V. O'Connor

Chairman, United States Shipping Board

THE duty of the United States shipping board as prescribed by congress is to develop and encourage the maintenance of an adequate merchant marine. This specific declaration was laid down by the merchant marine act of 1920, and now the new Jones-White act furnishes more adequate means for carrying this policy out. Regulatory and semijudicial responsibilities form a part of the board's duty under these acts. It is responsible for the development and encouragement of shipping controlled by citizens of the United States. Since the enactment of the 1920 law, the shipping board has made strenuous efforts to get the government out of the business in such a way that American citizens could purchase the government-owned tonnage and be able to continue its operation in the over-seas commerce of the United States, successfully competing with the ships of other nations. The great bulk of the tonnage that has been sold has been for unrestricted operation, while upward of 450 ships have been sold for scrap. However, 13 established lines with a total of 110 vessels, operating from American ports to over-seas foreign ports have been sold for guaranteed operation, and these lines are being operated successfully by private American owners today.

The extent to which the government has gone in withdrawing from the shipping business is readily recognized in the fact that 2500-odd ships were controlled by the shipping board in 1920 while only about 750 are now under the board's direction. In 1920, 1100 ships were being operated by the board. Now there are 215. In the past three or four years the greatest progress

in the transfer of established lines to private hands has been made. This year the board has been able to withdraw completely from the Pacific coast.

There were remaining three transpacific cargo lines with an aggregate of 37 vessels. One of these lines was operated from San Francisco, another from Portland, Oreg., and the third from Puget sound. Local interests, intent on trade development for their localities, became the purchasers of each line and there is every indication that the operation of these lines will be made permanent. With retirement from Pacific coast operation complete, attention has been directed to plans for liquidation of the Atlantic fleets. The latest accomplishment in this direction was the sale of the American West African line. The price of \$27.15 per deadweight ton obtained for these vessels was the highest ever offered for shipping board lines. It is seen that in the comparatively brief period of eight years the government has gone about two-thirds of the way out of the shipowning and ship-



T. V. O'Connor

operating business. This is particularly significant in view of the fact that it has been accomplished without the stimulus of adequate aids to our citizens who were willing to enter the business. There is no doubt that as years went on the citizens who have bought these vessels would have found difficulty in continuing their foreign trade operation. But congress this year, with a genuine desire to carry out its policy of permanently maintaining America's place upon the seas, has written into law aids for the encouragement of the private American shipowners. This law has given new stimulus to shipping.

American Marine Insurance Is Gradually Coming Into Its Own

Recent Legislation Removed Serious Obstacles—American Companies Able to Compete With Foreign Underwriters—Inland Business Shows Expansion

By E. C. Kreutzberg

OUTSTANDING among the developments in the field of marine insurance since the MARINE REVIEW began its career, 50 years ago, is the adoption of legislation which has the effect of removing obstacles from the path of American companies and of placing them on a par with their foreign competitors.

Of greatest significance is a model law defining marine insurance and its character and scope. It was approved by the President on March 4, 1922, and became effective for regulating marine insurance in the District of Columbia. A direct outgrowth of the interest in shipping and marine matters during the World war, the new law is the outcome of a thorough investigation conducted soon after the termination of the war, by Prof. S. S. Huebner, of the University of Pennsylvania, in behalf jointly of the United States shipping board and the subcommittee on merchant marine and fisheries of the house of representatives.

The war had had a profound effect on the marine insurance business. On the outbreak of the war in 1914 there developed a tremendous demand for war risk insurance. Many new marine insurance companies were organized, and many companies which had been established in the fire insurance business began to write marine risks. In addition, congress passed an act, approved Aug. 18, 1914, authorizing the secretary of the treasury to organize a bureau of war risks, with the result that the government wrote huge amounts of war risk insurance all during the war.

Study Marine Insurance

An object in mind when the joint investigation of the shipping board and subcommittee on merchant marine and fisheries was initiated, was to get the government out of the insurance business, but as the work progressed, the primary purpose was one of studying the problems of the marine insurance business and of

seeking ways in which to enable the American companies to hold their own in the world competition.

Of the numerous constructive features of the new law, that which appears to be most directly beneficial to the marine insurance companies provides that taxes against this business are to be levied on profits rather than on premiums. Prior to the adoption of the law, a hull insured for \$100,000 at 5 per cent in the United States paid a tax of approximately \$200, whereas in England the tax was around \$25. This difference in taxation methods gave English houses a great advantage in competing for business in the international market, and it meant a great deal in the years following the World war when destructive competition brought premiums to such low levels as to cause big losses in the writing of marine insurance. The new law, in directing that taxes are to be levied on the basis of profits, therefore, has the effect of placing American companies on a parity with foreign companies as far as taxation is concerned.

New York state amended its insurance laws in 1926 by adopting this taxation feature and the states of Pennsylvania and New Jersey have acted similarly during the past year. This action in New York is of particular importance, for the reason that 85 to 90 per cent of the country's business in marine insurance is written in New York. It is of considerable interest to note that this lowering of taxes against marine insurance was made at a time when New York state was seeking methods of increasing taxes, and the favorable treatment of the marine insurance business was accorded after the legislature had learned that such action was necessary in order to wipe out the disadvantage of New York in marine insurance as compared with London.

Another outgrowth of the investigation of the shipping board and the subcommittee on merchant marine and fisheries was an amendment to

the Sherman antitrust law which provided that combinations establishing syndicates in marine insurance should not be considered as in violation of that law. This amendment became a law in 1922, and was another reflection of the legislative attitude in favor of enabling our marine insurance business to compete against foreign countries. This amendment, by the way, was introduced by Congressman George W. Edmonds, Philadelphia, acting chairman of the subcommittee on merchant marine and fisheries, and who all along was conspicuous for the enlightened attitude he demonstrated with reference to marine insurance legislative requirements.

Syndicating Marine Insurance

As a result of the amendment permitting syndicating of marine insurance, the American Marine Insurance syndicates were organized in New York City for the purpose of syndicating insurance on all American ocean-going steel hulls. It now is possible for an American owner to insure a hull in a single policy placed with this syndicate. More than 100 American companies, comprising practically the entire marine insurance business in this country, are members and the name of each is on every policy, together with the share of the total risk assumed by each company. The organization of this syndicate has simplified greatly the placing of hull insurance, and it has been a great aid to American companies in obtaining a larger share of the American hull insurance business.

There have been other important developments since the war. Among them is the organization of the American Foreign Insurance association, of which some 25 American companies are members. This association has offices in all the principal ports of the world and hence American companies now are in a position to get an increasing portion of the business in the international marine insurance market. The success of this organization is made possible largely

by the establishment of American branch banks in foreign countries. In effect, the work of the organization is a good deal along the same lines as that by which English insurance companies in years past have spread their business all over the globe.

Americans Extensively Engaged

It is considered in marine circles generally that this extension of American marine insurance facilities abroad will prove extremely beneficial to American shipping generally, for the reason that marine insurance always has proved a strong weapon in the struggle for the world's trade. In fact, it is readily apparent that England's supremacy in the world's commerce has gone hand in hand with her methods of soliciting marine insurance, for the reason that information gained in writing marine insurance business points the way to where shipping business can be had.

An outstanding development in the American marine insurance business since the war is the extent to which Americans now are engaged in that business in this country. In the days before the war, it was customary to find insurance offices in this country manned largely by British citizens who had received their training in insurance work abroad. During the war, when it became vital to provide such insurance as would enable ship-owners to continue to operate their vessels, and in the years since, more attention than ever before has been devoted to marine insurance, and large numbers of Americans have received a thorough training in all the intricacies of this business. Many American offices today are manned throughout by Americans. An interesting development is that instructions in marine insurance now can be had at some of our institutions of learning, and text-books on marine insurance have made their appearance from the hands of American authors.

Following the above summary of the most important developments in the marine insurance business within recent years, a brief history of the business in the United States may be set forth. It is interesting to note that the year 1928 marks the two hundred and seventh year since the establishment of the business in this country. According to William D. Winter, third vice president, Atlantic Mutual Insurance Co., New York, the first marine insurance office was opened in Philadelphia in 1721 by John C. Capson, who said in an advertisement:

"The merchants of this city of Philadelphia and other ports have been obliged to send to London for

such insurance, which has not only been tedious and troublesome but even precarious, and for the remedy of which this office is opened."

Four years later another office was opened in Philadelphia by Francis Rawle. The first office in New York appears to have been opened in 1759, and another was opened in that city in 1778. These offices, according to Mr. Winter, were conducted on the English plan of individual or partnership underwriting, incorporated insurance companies not yet entering the field.

Philadelphia Was First Center

A feature of the early history is that the initiative in writing marine insurance in this country developed in Philadelphia. As a matter of fact, Philadelphia then was the country's metropolis and it continued as such until around 1840 to 1850, when the

were many corporations all eager for business and with the loss of the war risk premium destructive competition set in. Although the American merchant marine business was good, competition for marine insurance business continued destructive and it was not until about 1840 that this business again showed real prosperity.

Toward the end of the Civil war American shipping practically had disappeared from the seas, and only the strongest marine insurance companies survived. In 1861, 14 companies were writing marine insurance in New York. In 1867 only nine were left and all were suffering from absence of business. Foreign insurance companies then were beginning to establish themselves here; the first foreign company entered New York state in 1871, and by 1874 there were

Table I

Data on Marine Insurance Expansion

	1912	1914	1916
Number of American companies doing marine business	30	35	63
Marine and inland premiums American companies	20,335,000	25,084,000	58,748,000
Number of admitted foreign companies	29	30	33
Foreign companies through American organizations....	13,800,000	15,166,000	32,858,000

Table II

Marine Insurance Written in 1927

\$32,895,059 by 67 domestic companies on ocean marine insurance
10,811,709 by 36 foreign admitted companies on ocean marine insurance
29,691,711 by 89 domestic companies on inland marine insurance
9,774,571 by 39 foreign admitted companies on inland marine insurance
\$88,173,050 total premiums booked by domestic and foreign admitted companies in 1927

leadership of New York first became noticeable. The first corporations in the United States for writing marine insurance were the Insurance Co. of North America, Philadelphia, and the Insurance Co. of the State of Pennsylvania, Philadelphia, both of which were chartered under the laws of Pennsylvania in 1792. The first corporation in New York organized for handling such business was the Insurance Co. of New York, which in 1795 received a charter to operate under the laws of New York. Before 1800 there were marine insurance corporations in New York, Philadelphia, Boston, Baltimore, New Haven, Charleston and Newburyport, in all a total of 10 stock companies.

In the period 1790 to 1805, prosperous years for American shipping, the marine insurance companies enjoyed a fine business. The Napoleonic wars further stimulated demand for marine insurance, and an expansion of the market took place. With the end of the Napoleonic wars in 1815, and of our own War of 1812, there

seven foreign companies in the field. During the period 1878 to 1890, seven New York companies were forced into liquidation, representing assets of over \$5,000,000 at the time of discontinuance.

Conditions Have Improved

After that, there took place a gradual improvement. This may be described by quoting from an address before the fifth national foreign trade convention at Cincinnati, in 1918, delivered by Hendon Chubb, of Chubb & Son, New York. Mr. Chubb's address contained the following:

"In 1895, when I had my first personal knowledge of this business, the situation was that the American market, and in that term I include not only American companies and associations but also foreign companies domiciled over here and maintaining American organizations, carried the larger proportion of the cargo business of the country, that is to say, the insurance on exports and imports, but there was a very considerable proportion of this business handled under policies placed with underwriters having no

(Continued on Page 120)

Diesel Engine Progress In America

German Diesel Engineer's Impressions Not Flattering
—Misapprehensions Corrected—Industry Improving

By J. Barraja-Frauenfelder

AN ARTICLE by Dr. Ing. I. Lauster, published in the Dec. 17 number of the *Zeitschrift der Vereinigten Deutscher Ingenieure*, entitled "Impressions of My First American Trip," deserves attention. This article in my opinion should not pass without notice and comment due to the fact that it is based on various misconceptions and therefore puts the American diesel industry in the wrong perspective.

It is true that the article only intends to describe Doctor Lauster's own impressions, but if his impressions are based on incomplete premises then an injustice is done in the eyes of European readers to an industry which is now valiantly developing under handicaps not of its own making.

With a view to righting such a wrong as far as it is possible to do so I desire to present my own views and to comment on Doctor Lauster's article.

I begin with a translation of the article in as near a faithful construction as it is possible to make considering the grammatical and rhetorical differences between the two languages and the differences in the use of technical phraseology.

Translation from German of Dr. Ing. I. Lauster's Article

As a specialist in the diesel engine manufacturing field, I was especially interested in the development of this German invention under American conditions. This development, as is well known, is proceeding very hesitatingly, although the diesel engine after its advent was supposed to have been taken up with enthusiasm in America, with her giant resources of oil, etc. This phenomenon is due to the fact, as explained in a previous article, that the engine at its inception was too complicated for American operating and maintenance conditions, and as a matter of fact even too exacting for ordinary production. In addition to this there obviously existed a lack of up-to-date "manufacturing processes."

After the diesel engine had been in use in the various countries of Europe,

The author, J. Barraja-Frauenfelder, consulting diesel engineer, submitted this translation and his comments at the request of the editor.

in all possible applications, a half-hearted start was again made for its introduction in the United States. The art at first attained an appreciable impetus about 1910, by the acquisition of manufacturing licenses from Germany and later on from other countries. Now there appears to be as far as I can estimate, more than 20 factories (I visited 11 of them) devoted to the manufacture of diesel engines, up to the largest sizes com-

type to a high degree, for which due credit must be given them.

Large double acting, two and four cycle, engines have already been built, but the designers of these units are Europeans and they show their native influence, although they have tried to conform to American ideas as far as possible. It may be said that they have succeeded better in the double acting Worthington engine than in the double acting engine of McIntosh-Seymour design, with certain losses in economy. The latter double acting four-cycle engine is too complicated, the bottom cylinder head and the cylinder liner are not very accessible; nevertheless, this engine shows important advantages over the double acting four-cycle engine of Burmeister and Wain design.

It appears that the Nordberg company has, until recently, pursued its own design of single acting two and four cycle engines, patterned after European types. They have now acquired a license to manufacture from Fiat.

Reduction Gearing Is Used

The Falk company of Milwaukee are producing engines of its own design, i. e., engines of four-cycle type only, in varying numbers of cylinders and revolutions. In endeavoring to adapt this engine to various purposes, there has been added as a special product, the Bibby coupling and a gear transmission. The first named is an elastic coupling in order to avoid torsional vibrations and the latter is for use in high speed generating units and for reducing high engine speed to low speed for propelling ships. Lately the design of a transmission containing the reversing mechanism as well, thus simplifying the engine itself, has been proposed.

Extended evidence of an American tendency is also expressed by this firm in large cylinder units of more than 150 horsepower without piston cooling and airless injection. The Falk design is unusually heavy like most of the other American designs.

In general it may be stated that the Americans are not showing a tendency to economize weight. Thin walls in castings obviously make difficulties for

Diesel Engine Economy

THE diesel engine industry in the United States is working out its destiny in spite of many difficulties. Among these are the apparent indifference of the American ship owner and operator to the recognized thermal efficiency of this type of engine. Its superiority over the steam engine in sizes up to that used for the largest freighters is now generally conceded. The American shipowner should take advantage of this fact in considering new tonnage and in possible conversions to modernize existing vessels.

While in Europe well over one-half of all merchant tonnage now building is provided with diesel motive power, America strangely lags behind, especially in the larger sizes. Competition is going to make it imperative to look to low operating cost and it is vital that all encouragement be accorded our American diesel engine builders.

parable to our own four and two-cycle engines. Small and medium engines are being built without compressors, while the larger ones are being built with compressors. For the most part they are modeled after German types, or after the types of other European makes, licenses of which are held; all with major or minor modification to adapt them to American methods. The compressorless construction seems to be to the American mind of greater simplicity and this is the reason why greater practical results have been obtained in this direction. The Vickers company, England, have also developed such a

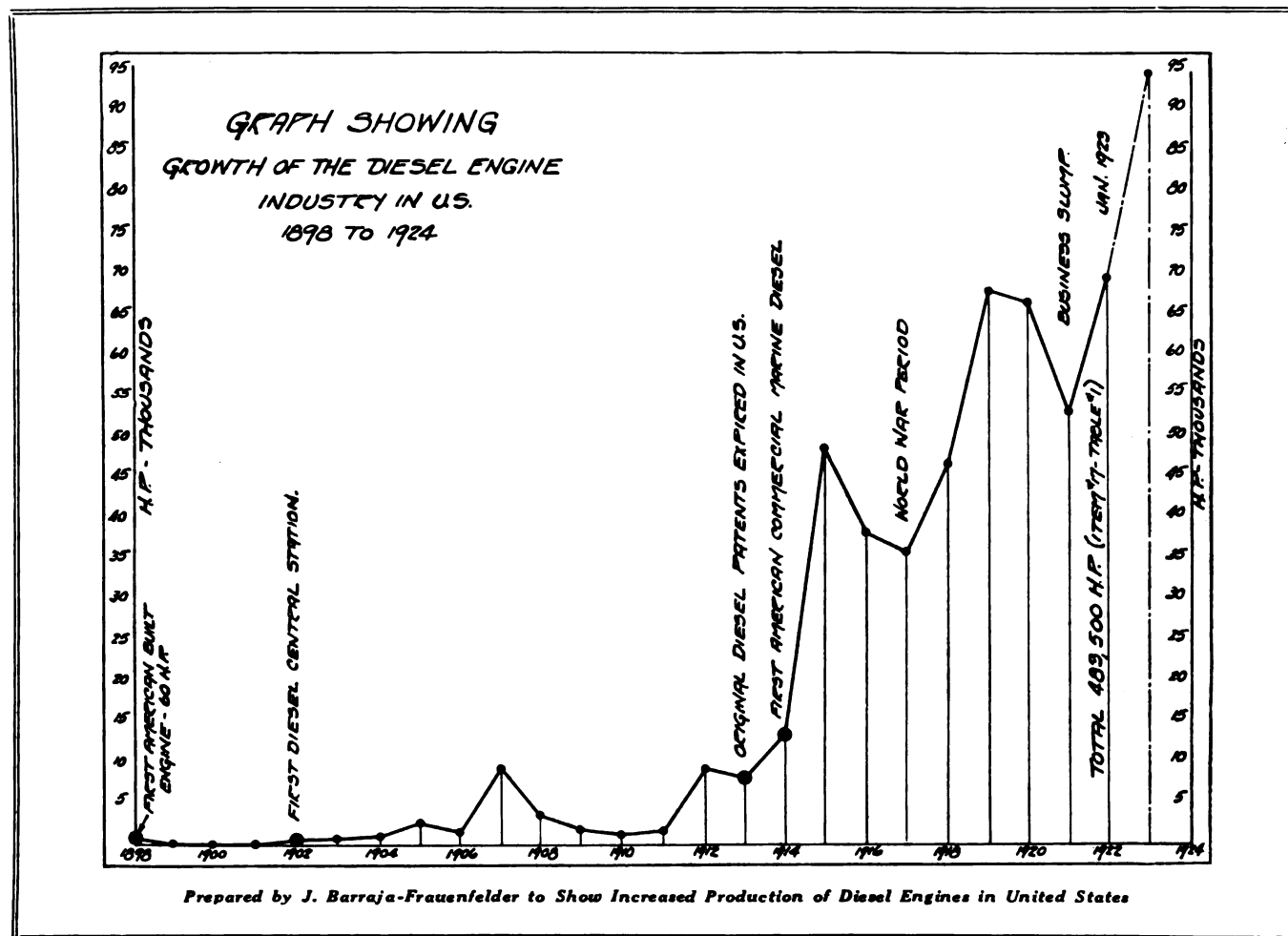
the foundry, hence wall thicknesses are increased to reduce manufacturing costs.

The above named diesel plants do not follow the principle of mass production to any great extent. Real mass production can only be found in the Fairbanks-Morse and De La Vergne plants. Fairbanks-Morse build diesel engines on a large scale, besides small gasoline motors, in perfect mass production. This firm can certainly be considered the largest and most noted in the world. The weekly production is approximately 5000 horsepower of

wanton waste in fuel. At any rate, in the United States all materials are cheap while wages are very high, consequently such things are considered legitimate. On account of its low price, this make is most feared in competition and is one of the most extensively used in America. Under the influence of the competitive economy of four-cycle engines, Fairbanks-Morse company is looking for means to improve the economy of its engines. If the cycle of this engine could be worked out so that the mean pressure would come nearer to that of the

completeness in development, a process which is not so simple even for American ingenuity.

This slower development in the larger size is explained by the demand which is not so great, but doubtlessly it will increase when American large units become an established fact. The indication now exists that the double acting two-cycle M. A. N. engine, which in the course of time will be made suitable for American conditions, will play a large role in competition. Of remarkable interest is the fact that the first double act-



small and medium sizes up to 100 horsepower per cylinder. The units are compressorless, two cycle, with crankcase-scavenging and are manufactured up to 600 horsepower in six cylinders. Their striking simplicity in appearance and maintenance is counteracted by a less intelligent economy in material. While the mean pressure in ordinary four-cycle engines is kept at the rate of 5 to 6 atmospheres (71 to 84 pounds per square inch), in the two-cycle engines only about 2.5 to 3.2 atmospheres (35 to 45 pounds per square inch) is obtained. This genuinely American conception would be considered in Germany worse than a

four-cycle engines, which does not seem possible to me, unless possibly by adding a special blower and by better scavenging, then the highly developed mass production of this firm would be insured for the future. The firm of Fairbanks-Morse displays in any case of trouble on a delivered engine the most courteous attitude and in case of doubt the cost of replacements is usually absorbed. Such procedure is possible only when corresponding profit in manufacturing will permit.

I did not notice mass production of this kind in units of several thousand horsepower. Such sizes still show in-

ing M. A. N. engine built by a licensee, the Hooven, Owens, Rentschler Co., Hamilton, O., was subjected to an uninterrupted 30-day trial at full load, which gave perfect satisfaction and no trouble. It was stated to me that it was the only engine in the United States which had stood such a trial and therefore made a deep impression, especially in the United States navy.

The sale of diesel engines in the United States bears a close relationship to the unit cost of independent power plants. More than in Germany the influence of the large electrical companies is felt, specially in
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Veterans Discuss Half Century of Achievement in Shipping

Many Interesting Facts From Personal Experiences of the
Remarkable Progress in Shipbuilding and Marine Engineering

THIS is the autobiography of an old wooden ship builder now in his ninety-first year. Born in New York in 1838, he received his education in public schools and the Free academy of New York, was apprentice in ship yards of William H. Webb and C. & R. Pollion, helped design the gunboat, WINONA, which was tried and delivered 63 days from signing construction contract, fitted out most of the motor boats of Portor's Beauford expedition, and built a 500-ton schooner, the AMELIA T. IRELAND, on Wyconico river, Maryland, and delivered her. In 1866, came west and in partnership with R. W. Lynn under firm name of Lynn & Craig, founded a wooden ship yard at Gibraltar, Mich., and built some 24 vessels up to 1882. Moved to Trenton, Mich., there built some of the largest ore carriers sailing on the lakes. Moved to Toledo to enlarge shipyard to build metal ships, sold yard to present owners 1906 and started metal yard with sons at Long Beach, Calif., and built the first metal boat south of San Francisco, and up to this time have built 137 boats under the firm name of Craig Ship Building Co.

At the time in 1866 when I came west most of the vessels of the lakes were canal schooners, carrying 500 tons of ore or coal, or 16,000 bushels of grain, so as to carry cargo for two canal boats of the Erie canal. Package freight and passenger steamers were about 150 feet to 200 feet in length and most of them high pressure. Wood was used for fuel as coal was expensive and would burn out boilers in two or three years. These schooners would take most of a week to unload, and were towed through the rivers by large tugs.

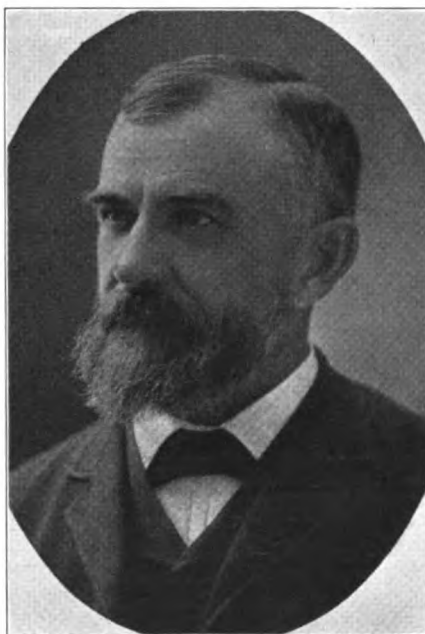
Schooners would make about six or seven trips per season from head of lakes or Chicago, to Buffalo. Lumber and grain were mostly the cargoes carried. If I remember right 100,000 tons of ore was carried to Lake Erie ports in 1866 and freights were as high as \$3 per ton, and I have seen wheat freight, as high as 19 cents per bushel. In 1867 the schooner

By John Craig

Veteran Ocean and Lakes Shipbuilder

er JAMES F. JOY was built to carry 1200 tons and it was considered wild and an extraordinary boat. It was thought that with a few of such boats that all the grain and lumber would be carried in half of the season.

At the time I speak of, I do not think there were over 100 men in the United States, who could lay down and draft a ship scientifically. In fact shipbuilding was an art and not a science. A builder built a ship just a little longer and a little more beam than his last one, and would then see if she was strong enough to carry her load. And thus the mer-



John Craig

chant marine of the lakes finally came up to steamers of present capacity, carrying 14,000 tons of ore and up to 400,000 bushels of grain.

Up to 1876 the draft of water was governed by water at Lime Kilns crossing which was 12 feet, which has been gradually increased to a draft of 19 feet ordinary weather.

And our facilities for handling ore

and coal have been so improved that it is now nothing uncommon for a steamer to come into Cleveland or Conneaut or Ashtabula at 6 a. m. unload 12,000 tons of ore, load 12,000 tons of coal and be out of port before sunset. The merchant marine of the lakes has become a science and in fact is now only a ferry—large steamers of ore companies, make a regular trip a week and many of them 30 to 35 cargoes per season of about 7½ months as navigation usually opens May 15 and closes Nov. 30. The old wooden steamers are almost all gone and also wooden ship builders, in fact today so far as I know besides myself, there is only one builder alive who was building ships in 1866, that is James Davidson, of Bay City, Mich.

But great improvements have been made, for instance we had no car ferries to carry cars over rough water. In 1892 we were asked if it was possible to build a ferry to carry cars across Lake Michigan, 60 miles of water and 500 feet deep. We finally made a contract to build a boat which would carry cars when a competent navigator would say it was safe for any boat to navigate, they were successful and ANN ARBOR Nos. 1 and 2 carried cars for three years before they were pronounced a success and now over 30 ferries are almost as regular in trips as railroad trains. The same kind of improvements have been made in loading and unloading coal, and ore. Loading coal from cars to ship is at the rate of a car of 75 tons in one and one half minutes. And ore can be unloaded at the rate of 40 tons per minute when desired with five unloading machines.

Passenger steamers by vicious legislation have almost been driven from the lakes. In my recollection we had ten passenger steamers going and coming out of Toledo, every day, and doing a profitable business, and most of the ports of the lakes the same, and now passenger business is only carried on package freight boats carrying railroad freight and this without benefit to anyone so far

as we can see. All brought about by the extra expense caused by increasing the number of men to navigate steamers which marine men think are superfluous. Toledo has today just one passenger steamer and it is an excursion boat, for people get hungry for a ride on the water. It is just wonderful when you think of it—everything going into the construction or fitout of a ship pays taxes—but when she is completed she has to compete in the markets of the world for work, with vessels costing about 60 per cent of our cost.

From the shovel which digs the ore or coal, the railroad which transports

it, the furnace and rolling mills which make it in plates and shapes, the workmen who fabricate it into ships at averages from 20 to 50 per cent above foreign workmen. Machinery and outfit all contribute to the support of our government, and when the ship is launched and completed, it has to enter competition with foreign ships built and manned at an approximate cost of 60 per cent of our ships, and we a maritime nation with over 12,000 miles of sea coast and inhabited with natural seamen, who have shown their ability as seamen and ship builders! Thousands of times I get out of all patience at

talk of subvention subsidy to help us to do our own work. There was a time even in my recollection, when the slogan was: "Free trade and sailors rights," but now we, on account of emigration, have developed a manufacturing nation, and what would you think of the brains of a business man, who would hire a competitor to deliver goods of his own make? How long do you think it would be before his competitor would have all his customers? And yet by the fear of the word *subsidy* we kill employment of over 200,000 men, instead of preparing ourselves to build ships for the world.

Over Sixty Years of Ship Design

FRANK E. KIRBY, dean of naval architecture in the United States, pioneer in the construction of iron boats, and outstanding figure for many years in designing and constructing, and later designer of steel ships for the Great Lakes, now is living in retirement at Bronxville, N. Y. Recently he received one of the editors of the *MARINE REVIEW* and consented to recount his recollections of some of the activities of a busy lifetime. Mr. Kirby was a young man of 29 when the *MARINE REVIEW* was launched as a publication 50 years ago, and his career dates back to the very beginning of the present era of ship design and shipbuilding. In fact, he began his connection with shipbuilding in 1864 when, as a lad of 15, he worked on a drawing board. At that time the shipbuilding wave of the Civil war period was at its height. He has continued actively in this career ever since until his retirement a few years ago.

Born in Dover county, Ohio on July 1, 1849, Frank E. Kirby descends from an old American family that settled at Plymouth, Mass., in 1635. His father was Capt. Stephen R. Kirby, who sailed the Great Lakes for about 14 years. The family home was in Cleveland and Frank had begun attending school there when Captain Kirby moved his family to Saginaw, Mich. There he built the old Bancroft hotel, several mills and other buildings, and numerous sailing craft and steamboats. Later, Captain Kirby was an organizer of the Detroit Dry Dock Co., and became its general manager. This company later was known as the Detroit Ship Building Co., and ultimately part of the American Ship Building Co.

Several turning points have a great

Frank E. Kirby

Famous Naval Architect and Marine Engineer

influence on the career of Frank E. Kirby. One of these was when his schooling came to an end. One of Captain Kirby's close friends was Jesse Hoyt, a New York flour merchant. On one of his visits to Saginaw, Mr. Hoyt talked with the boy about his future, and he offered to take him to New York where he would have an opportunity to study at the Cooper institute, then the only technical school of its kind in the United States. As a result, Frank E. Kirby came to New York in 1864, a boy of 15. It is of interest to note that the trip was made by boat to Buffalo, by train to Albany, and by boat from Albany to New York. The last leg of the trip was made on a vessel of the Hudson River Day line, for which, at a later date, Mr. Kirby was to design and build some of the finest vessels afloat on inland waters.

New York in 1864 was seething in activity connected with the conduct of the Civil war. Among other things New York then was the country's shipbuilding center, and ships were in process of construction along much of the New York waterfront. Even the old horse-drawn street cars used to pass through tunnels under the ship ways. The boy spent his evenings at the Cooper institute, which was a night school, and during the day he would spend his time largely in watching the building of ships. His father's friend, Jesse Hoyt, knowing the owners of the Hudson River Day line gave the boy a letter of introduction to them which the latter used to get thoroughly familiar with the Day line boats. At the school, the boy studied marine design and

ship construction, and all his spare time was devoted to investigations along this line. Among other things, Mr. Hoyt gave the lad a letter introducing him to Joseph Belknap, a leading marine consulting engineer, who later became the first supervising inspector general of the government steamboat inspection service.

One day, young Frank asked Mr. Hoyt for a letter of introduction to Russell Sage, president of the Pacific Mail Steamship Co. That line operated steamers to Panama where freight was unloaded and shipped by rail to the Pacific side, where in turn it was taken on other steamers for transportation to San Francisco and other destinations. The company then had under construction steamers which were to sail to China and Japan. Mr. Sage, a gruff man, asked the boy what he wanted and on hearing that the lad wanted a place on one of the boats that would sail to the Far East, he turned him over to W. W. Vanderbilt, a relative of the famous Commodore Vanderbilt, who had been appointed chief engineer of one of the boats. After some talk, the boy was signed on by Mr. Vanderbilt as an assistant engineer, his duties corresponding to those of the oilers of the present time.

But the trip to Japan and China was to be deferred for many years. A day or two later, while walking down Broadway past St. Paul's church, young Kirby saw Mr. Belknap coming along in the opposite direction. He called a greeting to Mr. Belknap, and the latter responded somewhat absently and the boy thought that Mr. Belknap probably had not recognized him. A couple of moments later, however, he felt a hand on his shoulder, and there was Mr. Belknap.

He said he had a job for Frank. He took the boy to his office and explained that he had charge of building two ferryboats to ply between Washington and Alexandria. He wanted young Kirby to go to work on the drawings for the engines for these boats at the Allaire Works in New York City, then one of the oldest and most famous engine building plants in America. That plant was so busy with government work that the management was unable to handle the drawings for these engines and that was the job that Mr. Belknap wanted young Kirby to handle. The latter had had some experience at drawing at the Cooper institute so he felt that, at the least, he could take a chance at the work.

Starts Drawing Ship Engines

Accordingly he went down to the Pacific Mail and told Mr. Vanderbilt that he had been offered this job and thought he would not go with the Pacific Mail. At first Mr. Vanderbilt tried to dissuade the boy from going to work at the Allaire plant, saying he would make a man of him. That night, however, he went to the boy's boarding house and told him he had better accept Mr. Belknap's offer as it was more likely to give him a future than the post with the Pacific Mail line.

So the boy went to work on the drafting board at the Allaire works. Soon after, John Roach, who later became famous as the iron shipbuilder of Chester, Pa., acquired the Allaire works, and young Kirby continued his employment there. Mr. Kirby recalls that when he first arrived in New York Mr. Hoyt took him to his residence on Thirty-fourth street. The only public conveyances then available were horse cars and in that neighborhood they traveled on irregular schedules and frequently failed to make any appearance at all. Inasmuch as the boy frequently had to walk all the way to Cooper institute, which meant spending about half a day in walking, arrangements were made for him to live at a boarding house located "in town."

At the boarding house was an engineer who had charge of a pumping plant then being erected at Belleville station in New Jersey, and there was trouble in connection with getting the engine to work. Young Kirby had picked up a good deal of information about engines at the Allaire works by that time, and he also was picking up information right along at the Cooper institute, where he continued to spend his evenings. So he accepted the engineer's invitation and spent some time with the engine,

getting is to work quite satisfactorily.

He undertook several other side activities of this kind. In 1870, while visiting a pumping plant in the marshlands of New Jersey, he got his feet wet and developed muscular rheumatism. He decided to go to Detroit, where his father was located, and where there was a physician whom he wanted to consult. While there, his friend Jesse Hoyt wired from New York that he was going to Saginaw and asking that he join the train at Detroit and go there with him. It happened that Captain Eber B. Ward, president of the Pere Marquette railroad and one of the leading figures in industry in his day, also joined the train there.

Mr. Hoyt introduced young Kirby to Captain Ward and the latter questioned the young man about his experience in New York. Captain Ward



Frank E. Kirby

commented on the increasing importance of the shipping on the Great Lakes, and was particularly interested because he had important iron mills, whereas iron was just coming into use in shipbuilding. There then were two iron ships on the Great Lakes. One was the ship *MERCHANT* which had been built in a temporary yard at Buffalo. The other was the United States gunboat *MICHIGAN* which had been built at Pittsburgh in 1844 and assembled at Erie.

"All these vessels," said Captain Ward, referring to the wooden boats on the lakes, "will be rebuilt in iron and it will be a great business."

Captain Ward wanted to build an iron boat and he found that young Kirby wanted to build the boat. Before the train reached Saginaw, the

two had reached an agreement. Mr. Kirby was to build a shipyard at Wyandotte, Mich., and build iron ships there for Captain Ward. Not only was this in good location for the reason that the vessels passed Wyandotte on the way up and down the lakes, but one of Captain Ward's rolling mills was located there. This was the Wyandotte Rolling Mills, as the operation was known. With a letter from Captain Ward, Mr. Kirby, then 21 years old, presented himself to S. L. Potter, in charge of Captain Ward's interests at Wyandotte, and work was soon begun on the shipyard which at once came to be known as the Wyandotte Shipbuilding Co. The waterfront was dredged out, the dirt being used to raise the shore level. Then, after making arrangements to have the work continued in his absence, he left for Glasgow, Scotland, to gather information about how the Scotch shipyards built iron ships. Accompanying him was his father, Capt. Stephen R. Kirby, then general manager of the Detroit Dry Dock Co. They returned in 1872, and Frank E. Kirby at once started construction of the *E. B. Ward Jr.*, the first iron vessel made in the first permanent iron shipbuilding yard on the great lakes.

Stop Operations of Shipyard

The great panic of 1873 halted operations at the Wyandotte yard for a time, and Mr. Kirby had difficulty in getting something to do. Among other things at that time, he supervised the construction of the last set of lock gates for the Soo canal, then owned by the State of Michigan. Then, the Detroit Dry Dock Co. obtained a contract to build a new vessel for the Detroit & Cleveland Navigation Co., and it leased the Wyandotte yard for the work, the understanding being that Frank E. Kirby would build the ship, and that his compensation would be 25 per cent of the profit.

At that time there was a great deal of doubt on the lakes as to whether iron boats were really seaworthy. A good many people were hard to convince that an iron vessel would float.

This boat, the first *CITY OF DETROIT*, was a great achievement for those days. Her best time between Cleveland and Detroit was 6 hours, 6 minutes and 10 seconds. She had 60 staterooms, which is of interest in view of the fact that boats operated by that line today have as many as 623 staterooms. Launched in 1878, the first *CITY OF DETROIT*, operated profitably for many years and finally was dismantled in 1914.

Captain Ward died suddenly, but his plants continued to be operated by his executors. Later, the Wyandotte shipyard was purchased by the Detroit Dry Dock Co., and Mr. Kirby became engineer and naval architect for that company. During his days with the yard at Wyandotte and with the Detroit Dry Dock Co., he built more than 200 iron and steel steamers for the great lakes trade. He built all the steamers for the Detroit & Cleveland Navigation Co., the Cleveland & Buffalo line, the Detroit & Windsor Ferry Co., the White Star line and boats for the old New York Central, Pennsylvania, Pere Marquette, Ann Arbor and other lake lines. The car ferry steamers of the Michigan Central, Grand Trunk, Pere Marquette and Ann Arbor railroads were built by him.

Some Profitable Shipbuilding

Subsequent developments confirmed the early expectations of Captain Ward that iron shipbuilding on the lakes had a rosy future. The Detroit Dry Dock Co. and its successor the Detroit Shipbuilding Co. paid dividends which over a long period averaged 80 per cent a year on the capital invested.

The yards at Detroit and Wyandotte were run along lines which the lake conditions made most desirable. The fact that the lakes were frozen in the winter made it essential to operate the boats full tilt while navigation was open. Repairs during the open season had to be rushed with

Mr. Kirby recalls one vessel which was built for \$193,000 during a time of depression. This price was considerably under the actual construction cost. A few months later the

boat was sold for \$240,000. A couple of months later it again changed hands for \$360,000. The financing of these boats was no problem, says Mr. Kirby, because there always was somebody who was willing to pay cash for an interest in one of them.

The success which attended the operation of the shipyards at Detroit and Wyandotte stimulated others to go into the business of iron ship building. Eventually too many concerns were in the business and the time came when ships were being sold below the cost of construction, so keen was the competition. Mr. Kirby gave careful thought to this condition and decided that a merger of the different yards was necessary, the high cost yards to be scrapped. As the result of his work over a period of a couple of years, the American Ship Building Co. was formed in 1898 and it took in all the shipyards on the great lakes.

Mr. Kirby thereupon withdrew from the shipbuilding business and engaged as a consulting naval and marine engineer. His headquarters were in Detroit but he had an office in New York, and his travels took him many places. He visited Russia for the Siberian railway. Associated with Mr. W. T. Donnelly, he constructed the dry dock and ship repair plant at Prince Rupert for the Canadian government. Associated with J. W. Willard he designed and supervised the construction of the Hudson river steamers, HENDRICK HUDSON, ROBERT FULTON, WASHINGTON IRVING and DEWITT CLINTON. Associated with his father, he designed the Erie grain elevator in Jersey City and also the elevator of Hiram Walker & Sons, Walkerville, Ont. He also designed

ferry steamers for the city of St. Louis. He was consulting engineer for the BERGEN, the first double-ended screw ferryboat in New York harbor. Mr. Kirby's work has taken him to Europe, South America, China, Japan and other distant parts of the world and he has been in every state of the union at one time or another.

Greatly Honored by Profession

Mr. Kirby has the distinction of receiving the first doctor of engineering degree of the University of Michigan. He served the City of Detroit for six years as water commissioner. During the Spanish-American war he served as consulting engineer for the war department at Washington and along the coast, his duties being the inspection, selection and refitting ships obtained for transportation of troops and supplies. In the World war he served as consulting engineer for the Submarine Boat Corp., at Newark, N. J., during the entire war, coming to Detroit at alternate weeks to assist the Ford Motor Co. in building the famous Eagle boats. He was called by the late President Roosevelt to revise the rules and regulations, safeguarding life in the United States marine passenger service. These rules were adopted and are in force today.

He is a member of the Army and Navy club of Detroit, Engineers club of New York City, honorary member of the Detroit Engineering society, American Society of Mechanical Engineers, American Society of Naval Architects and Marine Engineers, the Naval institute, Royal Society of Arts, Institute of Engineers and Ship Builders in Scotland, and London Institute of Naval Architects.

Visualize a Lesson of Fifty Years

WHEN one has reached the fiftieth birthday, which the MARINE REVIEW is celebrating in this number, it is always fascinating to look backwards and recall the many milestones of progress during the long journey, and perhaps dream a little of the future.

Probably the most outstanding element responsible for advancement in this period has been the application of scientific principles in the design of ships and their machinery and the passing of the old "rule of thumb"; in other words, the change of shipbuilding from an art to a science. While there still remain a number of gaps to be bridged between the

Prof. Herbert C. Sadler

Dean of Engineering, University of Michigan

predicted and absolute results, which only patient research can finally reduce to a minimum, the number of cases of failure is today comparatively insignificant. True it is that there will always be some disappointments, but these have been and will be in the future due to pioneering in new fields, where experience of all the facts is lacking. The marine field, owing to the conditions under which ships must operate, and over which we as humans have little or no control, must of necessity lead to conservatism, and hence too great credit

cannot be given to those bold pioneers who make the first steps toward increased efficiency.

Shipbuilding, after all, is only one member of the great engineering family, and although it has its own specific problems, it must of necessity draw upon the advances made not only in other branches of the profession, but also from those of many other allied sciences.

A brief survey of just a few examples in the past 50 years may suffice to illustrate this point. Researches in the realm of chemistry and metallurgy have led to the general substitution of steel for iron, the development of newer and better

materials not only in the iron family, but also in new alloys, that have had an enormous influence in the improvement both in design and economic operation.

The main and auxiliary machinery for ships has undergone some remarkable changes. In the field of steam the advantages of high pressures and good vacuum were realized at the beginning of this period, but the progress was somewhat slow and limited to comparatively small steps, not only on account of the machinery, but also by the materials available. Then came the turbine, as the result of years of research by Parsons, Curtis, De Laval and others, the crowning success of which is illustrated today in the MAURETANIA.

Concurrently with this development, has been a scientific analysis of heat losses, with the gradual increase in economics due to the utilization of waste heat for air preheating, economizers and superheat. The developments in the use of fuel oil, and latterly pulverized coal, and the work on combustion generally, have done much to advance the science of steam engineering.

The advent of the internal combustion engine into the marine field, represents another epoch. The possibilities of increased efficiency from a thermodynamic viewpoint, have finally been realized in practice.

The use of electricity as a medium by means of which the greatest advantage may be taken of economics

in various types of prime movers such as steam turbines or internal combustion engines, cannot but play an important role in the future. The electrical field is perhaps one of the most outstanding examples of the application of scientific principles and research to practical problems. How



Prof. Herbert C. Sadler

could modern motors and generators have been designed by rule of thumb methods?

One other phase of development should also be mentioned as illus-

trating where other advances in science have done much to help the marine field. The comfort and safety of those who go down to the sea in ships have been enormously increased by the introduction of such things as radio, and aids to navigation as represented in various instruments which have harnessed the principles of physics such as sound, heat, light, electricity, or gravity to useful ends. The development of the various registry societies, load line and bulkhead subdivision committees, have led to distinct advances in this category.

On the strictly human side, the life of the seaman has been materially benefited by the gradual recognition of certain principles of social science, and the general economic advantage of their application.

Many other phases of development during the past 50 years could doubtless be mentioned, but as stated at the beginning of this article, it would seem that the outstanding and perhaps fundamental factor responsible for all this has been the great advances in science and scientific methods, perhaps the greatest that has ever occurred in the history of the world.

Future generations will have a wonderful heritage, and who can say to what heights they may attain. The miracles of the past are the playthings of the children of today, and man is gradually advancing towards that end which was prophesied for him in the book of Genesis: "Dominion over the earth."

Lake Shipping Makes Huge Gain

By Harry Coulby

IN CONGRATULATING the MARINE REVIEW upon the beginning of its fiftieth year of service, I am not unmindful of the fact that much of the early data and romanticism of the Great Lakes would be unavailable to the historian of today, but for the foresight and wisdom of him who founded this publication.

It would be interesting if one could go back 50 years and read the minds of those concerned in the building up of lake commerce and find how far short their most optimistic views of the future greatness of this commerce fell when compared with today's reality.

In 1877—the year of navigation just preceding the establishing of the MARINE REVIEW—the iron ore movement on the lakes totaled 1,010,494 gross tons from the Marquette range and initial shipments from the then recently discovered Menominee range

amounted to 4593 tons. The marvelous Mesabi range and the Gogebic and Vermilion ranges which have since produced a combined total of 1,000,268,749 gross tons were undreamed of. In 1877, too, the season's total traffic through the Sault amounted to 912,639 net tons which included total shipments of 1,349,738 bushels of grain and 91,575 net tons of coal.

Fifty years later, that is, the season of 1927, when bulk freight commodities moved in just normal trend the commerce of the four upper lakes amounted to 120,760,195 net tons transported without strain upon the part of a single fleet or ship; the wheat movement through the Sault alone totaled 330,898,158 bushels and the coal movement through the same waterway reached 17,107,500 net tons.

In the rapid development of the mineral and agricultural resources of the Northwest inventive genius was called upon to devise highly specialized methods in the short space of eight or nine months available for navigation. In the transition of the lake fleet from the small wooden steamers and sailing craft of barely 1000 tons capacity whose trade was largely confined to lumber and grain, to the present steel fleet that has risen to a maximum of 15,000 tons capacity, the primary transportation developments included the introduction to freight movement by water of the lake-type of bulk freighter, the most rapid loading and unloading facilities yet known in the world of transportation and an organization of vessel owners through which the ever increasing commerce could be handled adequately and economically.

Although the steam barge R. J.

HACKETT, the forerunner of the bulk freighter, came out in 1870, and although the first steel steamer to be built for the lake trade came out in 1886 and steel vessels had become rather common in the ore trade by 1891-92, it was not until 1900 that the first 500-footers appeared, it was not until 1902 that a bulk freighter, the JAMES H. HOYT, was constructed to meet the rapid loading facilities of the ore loading docks by having hatches spaced 12-foot centers and it was not until 1905 that a bulk freighter was constructed in a manner to meet the requirements of both rapid loading facilities of the upper lakes loading docks and the rapid unloading facilities provided by the Hulett machines at the lower lake docks.

Beginning of Growth

With this great improvement dates the beginning of the marvelous growth of the lake trade as domestic and foreign demands required. Therefore from 1905 on improvements have been necessary only along lines of economic handling, such as vessels of greater length, breadth and depth and increasingly rapid loading and unloading equipment on the docks. In this connection it is timely to mention that from the R. J. HACKETT, the first ship with engines aft, 211 feet long, 33-foot beam, 749 net registered tons and perhaps 1000 tons capacity, the American fleet of bulk freighters consisting of 345 steel steamers includes 74 ships 600 feet or more long with the acme of shipbuilding practice reflected so far in a bulk freighter 630¾ feet long overall, 607 feet long on the keel, 65-foot beam, 33-foot depth, 9467 gross registered tons and built to carry 14,000 gross tons of cargo.

For the stone trade that has been a commodity of rapid development during the past 15 years at least, and is highly specialized another distinctive lake type of vessel was conceived—the self unloader. From the first vessel of this type, built in 1908, 366 feet long and of less than 3000 tons capacity, year by year growth has resulted in a self-unloading steamer that is 638 feet long overall and which in the deep water between the loading port at Calcite to the unloading port at Buffington, Ind., has transported a cargo of 15,724 gross tons, or 17,546 net tons of limestone.

To trace intelligently the growth of the lake trade and the lake type bulk freighter, note must be taken of the coincident development of the unloading machine. In primitive days when iron ore was brought down the

lakes in schooners, unloading was by wheelbarrow, a four-day job for a cargo of 300 tons; then followed the block, tackle and horse means of unloading to be improved upon a little later by the donkey engine that hoisted the ore in buckets. In 1882 the first Brown hoist rig was installed, and then there came in rapid succession marked improvements on this instrument for unloading together with the Hoover and Mason machine to the present efficient Hulett unloader. That these instruments for rapidity and cheapness of transportation have attracted world-wide attention may well be understood when it is realized that in the course of the 1927 iron ore movement totaling more than 51 million gross tons the average time spent in port receiving and discharging cargoes was only 17 hours and 19 minutes, as compared with 58 hours and 38 minutes in 1906.



Harry Coulby

Celerity of dispatch reached maximum figures on an occasion when a steamer took on 12,508 gross tons of iron ore in 16½ minutes and was discharged of this cargo in 2 hours and 30 minutes, a rate of 4056 2/3 gross tons per hour. Moreover the highly efficient coal dumpers have put 14,000 net tons of coal in the cargo compartments of a bulk freighter at the rate of 3165 tons per hour.

Increasing Channel Depth

In the early days of iron ore movement, loading depths by reason of the shallow channels in St. Marys river and the waterway connecting Lakes Huron and Erie were restricted to 12 feet; depth in the first ship

canal known as the State canal, at Sault Ste. Marie, was about 13 feet, and in the locks about 11½ feet. The Weitzel lock (1870-1881) gave 17 feet of water and was 515 feet long. The Poe lock (1887 to 1896) 800 feet long and 100 feet wide, and the Davis (1908 to 1914) and Fourth locks (1913 to 1919) each 1350 feet long, 80 feet wide and having 24½ feet of water upon its water sills at low water datum, lent tremendous impetus to the growth of the lake trade in the years as above enumerated. The West Neebish channel in the St. Marys river opened in 1908, the Livingstone channel opened in 1912 with widening operations completed in 1925; together with improvements to Amherstburg channel and through Lake St. Clair and river were major projects that increased loading depths under favorable lake levels to 20 feet. There is now in prospect furthering deepening of the main channels to 24 feet.

Lake Carriers' Association

Outstanding in the growth of lake commerce has been the spirit of cooperation, through organization of the vessel owners. To serve mutual interests in the transportation of freight, to further movements tending toward safe navigation and in furtherance of the well being of the men who man the ships, the present Lake Carriers association as a voluntary organization resulted from an amalgamation on April 28, 1892 of the Cleveland Vessel Owners association which has been in existence since the early eighties, and an association also known as the Lake Carriers association with headquarters at Buffalo. The late M. A. Bradley of Cleveland was its first president. In 1902 it was reorganized by changing it from a voluntary association of vessel owners to a body corporate to carry out the same general purposes for which it was originally organized as well as other policies and undertakings which changed conditions seemed to require that the association take in charge. William Livingstone of Detroit was elected president and he remained continuously at the head of the organization until his death in 1925 when he was succeeded by J. S. Ashley of Cleveland.

During its 25 years' history the present Lake Carriers' association has accomplished much for the benefit of lake transportation interests in procuring and maintaining the establishment of aids to navigation, the removal of obstructions and in the effectiveness of its efforts to procure deep waterways and harbor improve-

(Continued on Page 123)

Shipping On the Great Lakes Is An Indispensable Asset to Business



Hulett Machines Unloading Iron Ore from Great Lakes Bulk Cargo Carrier

Without Its Remarkable Development During These Fifty Years the Steel Industry of America Could Not Have Grown to Its Present Great Proportions and Low Cost Production

By J. F. Froggett

FOUNDING of MARINE REVIEW in 1878 through its predecessor MARINE RECORD took place just at the first important turning point in the history of Lake Superior mining and transportation of iron ore, and the advent of the modern shipbuilding and dock equipment inventing era. Bold spirits from Cleveland, Youngstown, O., and elsewhere had been investing their funds in explorations for iron ore in the Old range country of the northern Michigan peninsula which still bears their names, while small wooden sailing vessels were bringing down cargoes of this hard, coarse ore which then ran 65 to 67 per cent iron. Only two ranges that year were shipping iron ore, the Marquette and the Menominee.

Three years after MARINE REVIEW first was issued, or on June 9, 1881, the second or Weitzel locks were thrown open at the Soo. The first or Harvey locks at that point had been opened originally on April 19, 1855. The 60-foot wide Canadian locks were opened in 1895, and the third

American lock named the Poe lock after Gen. O. M. Poe, was opened in 1896, it being built on the site of the original Harvey lock that had become antiquated for such rapidly growing lake traffic.

Six years after MARINE REVIEW was founded, or in 1884, the Gogebic range in northern Wisconsin became an ore shipper with 1022 tons; and the Vermilion range in Minnesota, the same year with 62,124 tons. The great Mesabi range did not become a shipper until 1892 with 4245 tons, in which year the Mayville, Wis., range also began to ship with 9044 tons. The latest range to ship ore was the Cuyuna in Minnesota which started off in 1911 with 147,649 tons. The greatest year's shipments of iron ore from all these ranges was the war year of 1916 with a total of 66,903,300 tons to which the Mesabi alone contributed a total of 42,526,025 tons.

The passenger traffic on the Great Lakes since then has grown to tremendous proportions. Last year there were carried on United States in-

spected vessels at the principal ports over 15,000,000 people. This figure does not include additional millions carried on ferry boats as at Detroit-Windsor, the automobile ferries as at St. Ignace, Mich., beside the hundreds of motor ferry boats employed all along the lakes and similar conveyances.

A wave of shipbuilding revival struck the country in 1880 and lasted for several years. Secretary of the Navy Chandler got a bill through congress appropriating funds for a steel cruiser of 4300 tons, two cruisers of 2500 and 3000 tons and a dispatch boat. On the lakes, 48 sailing vessels of 5447 tons and 182 steamers of 38,237 tons were launched. General Grant was talking about a ship canal through Nicaragua, and the Michigan Central railroad had launched its first Detroit river car ferry carrying 34 cars on three tracks. Siemens' fuel gas, a recent invention, was discussed editorially as the possible "fuel of the future" on lake vessels instead of raw coal.

MARINE REVIEW had shown con-

siderable enterprise in printing pig iron quotations, grain news, etc. in each week's issue, but in 1890 it also began to publish financial news respecting the various individual iron ore mining concerns, an advertiser stockbroker at Cleveland offering stocks in them "on about 10 per cent dividend basis." Among such were the Republic Iron Co., Lake Superior Iron Co., Champion Iron Co., Minnesota Iron Co., Jackson Iron Co., Cleveland Iron Mining Co., Chandler Iron Co. and Chicago & Minnesota Ore Co., all of which once famous properties have been since absorbed into either big steel or ore concerns and their individual indentities have disappeared.

End of the Wooden Ship

Describing the shipbuilding revival that again had set in, MARINE REVIEW points out in 1890 that more tonnage had been launched on the lakes since 1886 than then was afloat. The Pennsylvania railroad is announced as going in big for ore docks at Cleveland, to be equipped with a fast unloading plant upon which \$800,000 will be expended. This plant is expected to unload a steamer of 2300 to 2700 tons in a single day. Today that Pennsylvania dock at Cleveland unloads 10,000 to 12,000 tons of ore from a steamer in something like 3 or 4 hours. As it stands today it cost probably several times the original appropriation. Capt. George McKay, of the Cleveland Vessel Owners' association, recommends that beer kegs (then quite common) should be thrown overboard and anchored as buoys in shallow places, there being few government markers, and the modern gas buoy being still a matter of the future. Indeed, when the first gas buoys, 15 of them, were bought with an appropriation of \$30,000 by congress, it was found no provision in the fund had been made for maintaining them with renewals from the Pintsch gas plants at Galion, O., and Detroit, which delayed the use of the 5 bought for the lakes for another year. About this time MARINE REVIEW remarks:

"The feeling is rapidly growing, although scoffed at a few years ago, that this steel ship building will continue until the last oaken hull has been displaced." There are today a few of the wooden ships left on the lakes as barges and sand-suckers, etc. but back in the early 90's even as staunch a champion of the wooden ship as Capt. James Davidson, of Bay City, Mich., had turned from

the use of wood to that of steel in vessel construction. Talking of the CASTALIA, new ship just brought out by H. H. Brown & Co., Cleveland, MARINE REVIEW remarks that "even the rooms occupied by the deck hands have Brussels carpet, marble wash stands and incandescent lights." It also throws further sidelight upon the lake labor problem while speaking of the steamer LASALLE making its first trip from Escanaba with 2382 tons of ore, 283 feet over all, with speed of 10½ miles an hour, that J. S. Fay, president of the Lake Superior Iron Co., Boston, owner of the LASALLE, who had calculated its carrying capacity, speed, etc. to a nicety so it could be unloaded at port in one known day, said this ship was thus constructed and operated designedly in order "to save the blood money demanded by ore handlers for night work."

In a carefully written article appearing in that year in this journal the standard theoretic rule in ship building is laid down to be the ratio of beam to length 9 and depth to length 14, this applying especially to lake vessels. However, Lloyd's rule was stated to be depth to length not over 11. Some authorities on the lakes then figured on 400 horsepower to the mile of speed. It is hardly necessary to say that today no shipbuilder on the lakes pays attention to any such rule of thumb. Hydraulic steering gear was now introduced on the lakes. There was considerable discussion in MARINE REVIEW over a practice of some vesselmen "crossing the steering chains," steamboat-wise, while others do not, and this makes for confusion in directing the wheelsman. Demand is made for a uniform system of steering on the lakes, the Cleveland Vessel Owners' association standing out for "straight chains."

The Leading Ore Ports

Out of nine ore ports on the lower lakes, MARINE REVIEW points out in its issue of Sept. 25, 1891, Ashtabula leads with capacity for handling 26,070 tons daily, Cleveland being second with 25,400 tons daily. In coal, Buffalo leads with capacity for handling 28,000 tons daily and Cleveland is second with 12,200 tons daily capacity. Which brings to mind the remarkable story of the development of lake port equipment for handling materials in bulk. While the modern unloading equipment today is utterly unlike in appearance that employed 50 years ago, yet some of the under-

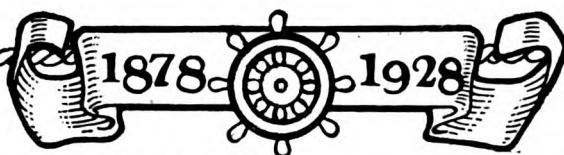
lying practical principles remain, and some of the elements in the old-time vessel unloading charge persist even today in a fictional sort of way in today's freight rates.

At the very beginning of the Lake Superior iron ore trade, the small wooden schooners that tied up at lower lake docks for unloading carried most of their ore cargo on deck. This ore at first was discharged to dock by day laborers using wheelbarrows and planks laid to the dock. Later horses were employed to wind up a rope on a drum mounted on the dock, the rope raising a tub containing about 1 ton of ore which had been shoveled into it when lowered to the vessel's deck or hold. Several days were required to discharge in that crude, back-breaking manner, the cargo of one schooner of several hundred tons.

Horsepower was displaced in 1867 by a small engine in lifting the loaded tubs from the holds of schooners, the first one being built by Bothwell & Ferris, which firm operated then the old Nypano (now Erie railroad) dock at Cleveland. This was a sensational move at the time and was considered to be making vast progress. The McMyler Mfg. Co. of Cleveland about the latter part of the '70's put out a revolving steam hoist carrying a short boom that lifted the loaded bucket from the hold of the vessel, swung it around to the dock and deposited its load there, which then had to be wheeled away into piles.

Unloading By Machinery

The high cost of hand shoveling and wheeling away this dock ore, together with the difficulty of clearing the docks for further operating, stimulated the inventive genius of Alexander E. Brown, son of Fayette Brown of Cleveland. In 1880 the young man developed a system of hoisting and conveying by machinery, establishing the first Brown unloading machine on the Erie dock at Cleveland. It was a single cable-worked rig, the stop being subject to lowering and dumping the bucket. There were five rigs with the machinery all in one house. The bucket was filled by hand shoveling. This development by Brown greatly reduced the unloading time and costs. In 1882 Robert Aspin built on the docks of the Illinois Steel Co. at South Chicago, which docks he had designed and constructed, the Champion ore hoist, the first unloading machine with cable and bucket to be used on Lake Michigan. They continued to be used at South Chicago until 1906, when they were replaced



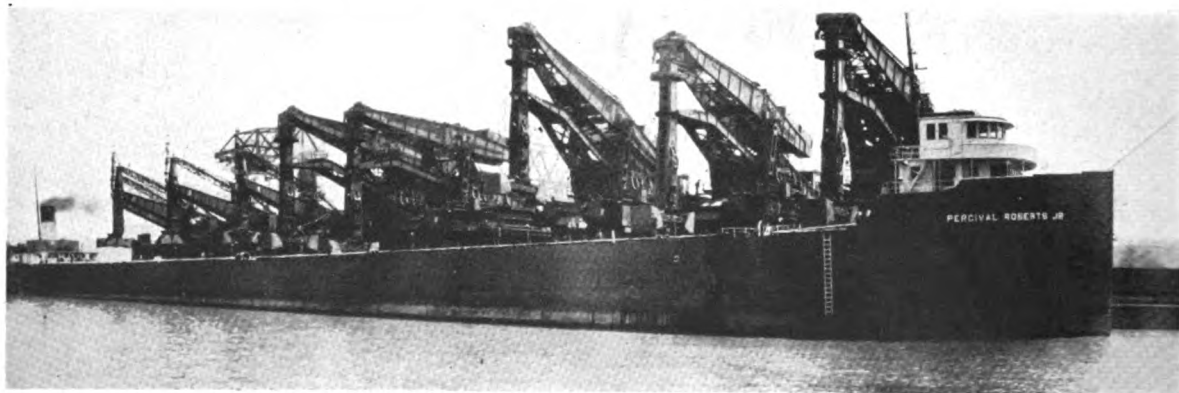
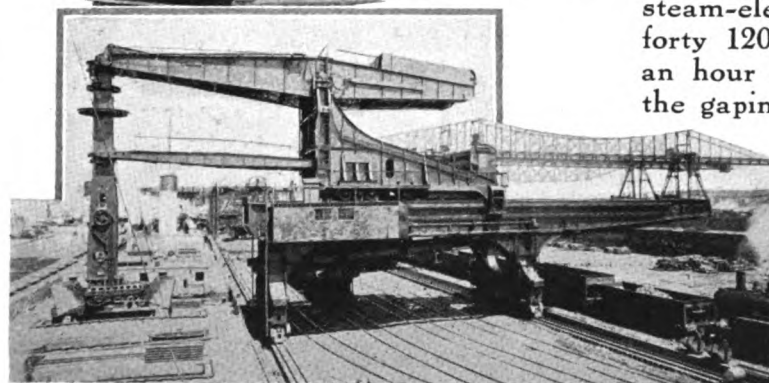
Efficient Bulk Material Handling

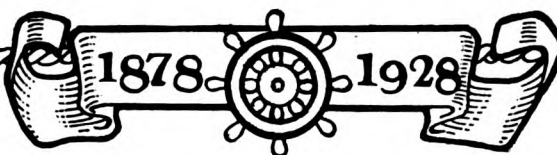


IN 1850, the first cargo of coal destined for upper lake ports was loaded by hand into vessels of 150 to 200 tons capacity. At port, it was manually unloaded.

Today, all-electric or combination steam-electric car dumpers pick up forty 120-ton capacity railroad cars an hour and discharge the coal into the gaping holds of boats of 13,000 tons capacity or greater.

At the lower lake ports, iron ore now is discharged at the rate of 17 to 20 tons a bite by Hulett unloaders. Several of these giants often work together in unloading a bulk carrier.

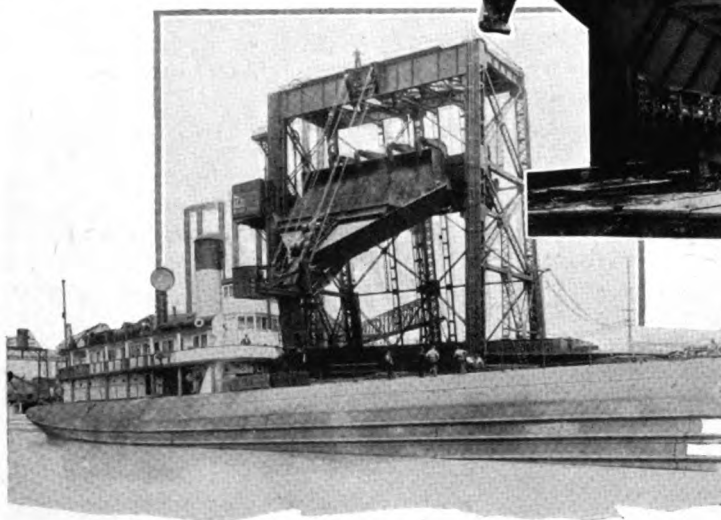
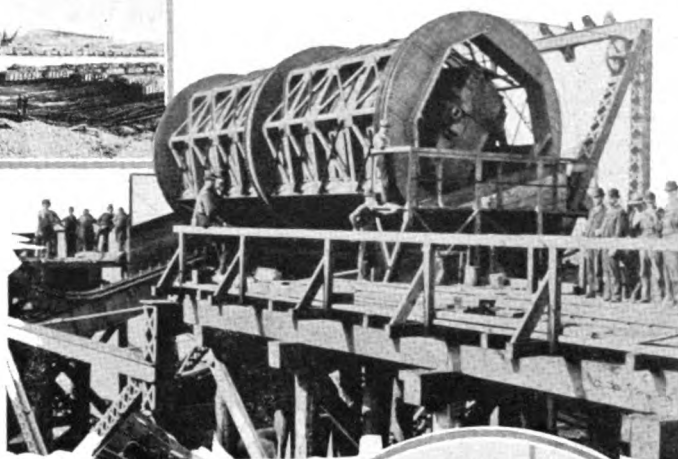




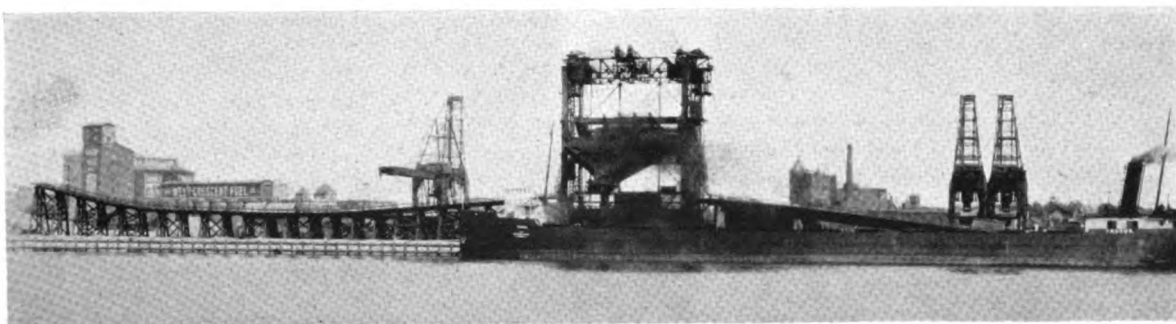
Shapes Destiny of Lake Shipping



A PICTORIAL history of the car dumper. At the top is one of the very first dumpers — the end-dump type which soon gave way to the rotary type shown at the upper right. The trimmer immediately beneath this distributes the coal in the hatches with minimum breakage, the coal virtually flowing from car to hatch.



AT the left is a steam-electric dumper. The one below is run by electricity, nearly 1400 h. p. in all. The switchback returns the empties to switching yard.



by the Hoover & Mason machines using the grab bucket. Brown Hoist and Hoover & Mason machines continued to develop along modern lines, using the clam shell, and are used extensively at this time for handling coal as well as iron ore, Brown rigs being installed at various large plants around the world.

The third development in ore unloading machinery was the invention of George H. Hulett of Cleveland, built by the Wellman-Seaver-Morgan Co. This stiff-legged machine with its operator descends into the hold of the vessel, brings up a self-filled bucket and deposits its contents on the dock. Hulett in 1899 established his first machines on the Conneaut, O., dock of the Carnegie Steel Co. and since then they have been established at other ports which have set up unloading records for the Great Lakes. The application of electricity to all these unloading machines aided greatly in their practical development and efficiency.

In 1927 these soft coal shipments in the navigating season amounted to 32,851,681 tons plus the hard coal shipments of 1,942,610 tons, or a total of 34,794,291 tons.

This vast coal movement developed mechanical appliances for its quick and cheap handling, just as did the ore flood. From the wheelbarrow stage, came about the "shooting" of coal into vessel hold through the operation of removable-bottom hopper cars. Today there are a number of fast coal-loading plants at lower lake ports which pick up the entire car, turn it over and dump the contents at one operation into the hold of the vessel. Some astonishing records in coal-loading thus have been established along Lake Erie.

Several soft coal loading records were established in 1927. On April 30, the Hocking Valley dock at Toledo with two machines dumped 1126 cars of coal in the 46-hour period, against the previous record of 1119 cars. On May 8 the two machines at Sandusky dumped 1254 cars in a 46-hour period, while on May 28 the dumpers at the Hocking Valley dock worked out 1402 cars in 46 hours. The nine Lake Erie docks on May 18, 1927, dumped a total of 4734 cars, or about 250,000 net tons of coal, against the former record of 4561 cars dumped in a single day on July 21, 1921. The Conneaut coal dumper on Nov. 18 made its best record for the season when it loaded 241 cars or 10,958 net tons of soft coal into the steamer J. G. BUTLER JR. in 5 hours and 45 minutes. However, the record established by the Conneaut dock was on July 30, 1921, when it loaded into the D. G. KERR 13,876½

tons of cargo coal and 368.95 tons of fuel in 4 hours and 30 minutes, or 3165.6 tons an hour. The anthracite loading record was established by the Delaware, Lackawanna & Western dock at Buffalo in 1920 when it loaded the steamer CRETE with 9606 tons of hard coal in 6 hours and 50 minutes, or 1406 tons an hour. The same dock in 1920 loaded onto the HENRY G. DALTON the largest cargo of hard coal ever carried on the lakes, 14,614 net tons, in 11 hours and 15 minutes, or 1299 tons an hour.

Records for unloading coal at upper lake docks also prove interesting. The Berwind dock at Duluth in 1915 took out of the steamer LEONARD C. HANNA 10,073 net tons of soft coal in 7 hours and 55 minutes, or 1272 tons an hour. The Duluth, Missabe & Northern coal dock at Duluth in 1919 unloaded from the steamer WM. A. MCGONAGLE 14,269 net tons of soft coal in 12 hours and 25 minutes, or 1149¼ tons an hour.

Increasing Coal Movement

From the pioneering days of the late 50's when Dr. Leonard C. Hanna and Samuel Livingston Mather used to dispatch from Cleveland up the lakes in sailing vessels to their ore explorers and mine workmen all sorts of supplies necessary for use and comfort in the then backwoods, to the modern coal movement from lower lake docks to supply the Northwest with coal for the ensuing winter, is a far cry.

Buffalo for years has been noted as an unloading port for grain. Even back in the years when Ohio and later Indiana furnished much of the wheat for market, it went eastward to Buffalo largely by water for further transport by railroad to the seaboard. Later as the Northwest developed into a vast granary for wheat, corn, flax and other grains, the grain movement down the lakes took its place alongside of iron ore as to volume. Last year for the first time in the history of the Soo locks the shipments of wheat through that gateway exceeded 300 million bushels, actually aggregating 330,898,158 bushels, against the previous record of 292,817,942 bushels in 1925. The 1927 total for all grains from the head of the lakes of 450,417,707 bushels is the second largest that ever passed through the Soo locks. However, the entire lake movement of grain last year made a total of 515,193,534 bushels or 14,692,536 net tons, second only to 1924, which with an unusually heavy harvest exceeded 543 million bushels of all grains.

The total number of cargo carriers on the Great Lakes embraced in the

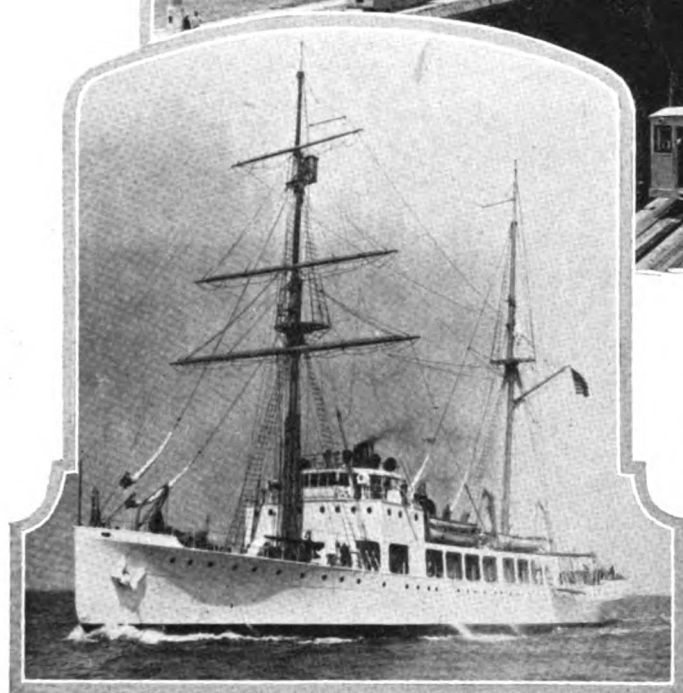
membership of the Lake Carriers' association is 346 with combined capacity on draft of 19 feet of water of 2,847,000 tons of iron ore per trip, making an average size of 8228 tons. The Pittsburgh Steamship Co. has 88 vessels, ranging downward from the PARGNY and KERR of 11,400 tons capacity to MARITANA of 4000 tons, and with combined capacity of 712,000 tons per trip. Next in size comes the Interlake Steamship Co., largest independent, with 45 vessels of 380,000 tons combined carrying capacity; third, Hutchinson & Co. with 22 vessels of 190,500 tons capacity, and the Cleveland-Cliffs Iron Co. also with 22 vessels of 163,900 tons capacity, the Great Lakes Steamship Co. with 19 vessels of 144,300 tons capacity, G. A. Tomlinson, 17 vessels with 140,300 tons capacity, Boland & Cornelius with 17 vessels of 139,800 tons capacity, the M. A. Hanna Co. with 15 vessels of 138,900 tons capacity, and so on, including several large coal companies.

However, consolidations had begun to be effected along the Great Lakes long before this time, or in 1891. MARINE REVIEW in its issue of May 14, 1891, notes the \$5,000,000 consolidation of the Cleveland Iron Mining Co. and of the Iron Cliffs Co., producing 550,000 tons of iron ore in the preceding year. The trustees named for the stock transfer were E. R. Perkins, J. H. Wade Jr., and William G. Mather. This now is the Cleveland-Cliffs Iron Co. of Cleveland, of which Mr. Mather is president.

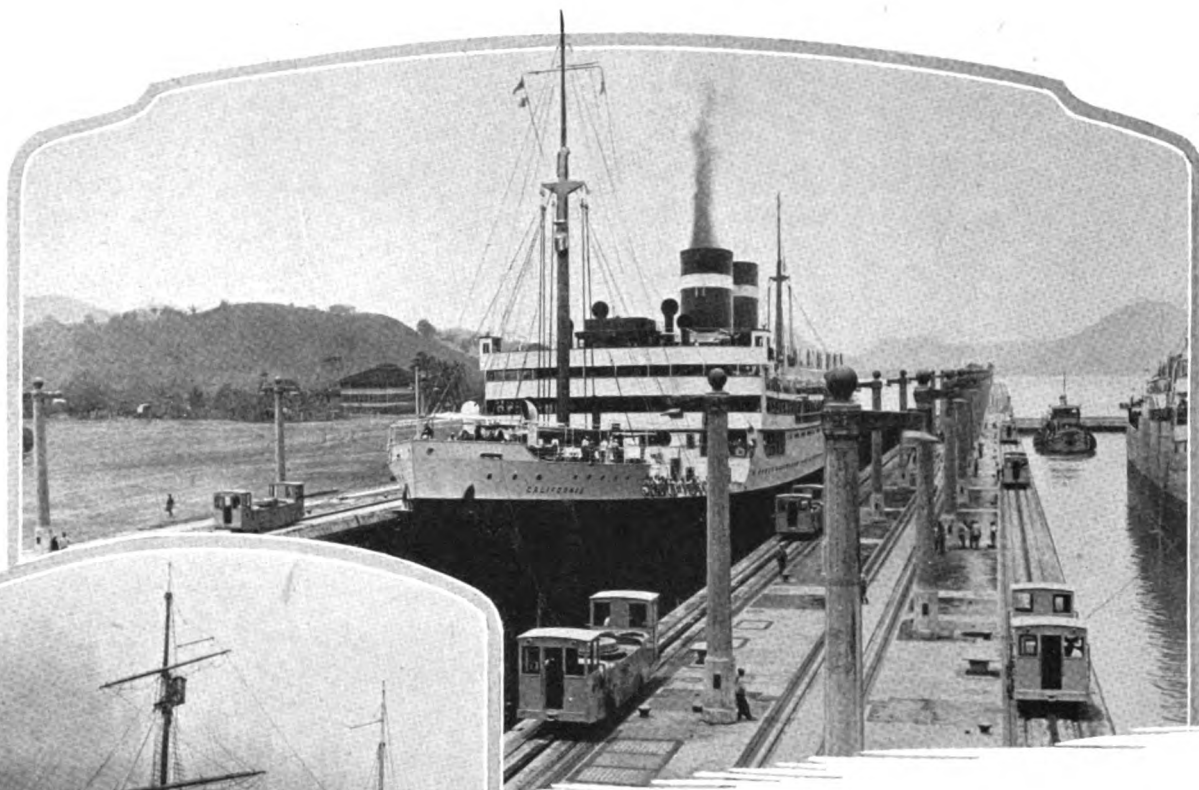
That same year another consolidation took place which later had important industrial bearings. MARINE REVIEW notes in its July 30, 1891, number that the Chicago & Minnesota Ore Co. and the Chandler Mining Co. have combined into the Minnesota Ore Co., including railroads, etc., which had affiliations with the Illinois Steel Co. of Chicago. These properties later became part of United States Steel Corp.

By the year 1898, with its Spanish-American war demands upon the iron and steel industry, the Great Lakes ore and navigation industries had become so thoroughly well organized that the war needs created not a ripple. Very well grounded were the principles upon which they were established.

Even the stress of the Great war demand for iron ore, coal, and grain did not strain the capabilities of the Great Lakes vessel and dock system. For instance, 66,672,881 tons of iron ore were moved in 1916. In 1927 a total of 51,107,136 tons of ore were moved by the fleet and it was considered a rather slow year. Probably as much at least will be moved in 1928.



Diesel Electric Coast Guard Cutter Northland



Turbine Electric Liner California Passing Through Panama Canal

Electric Power

A Modern Development in Efficient Ship Propulsion

By Frank V. Smith

ELECTRICITY is the greatest gift to mankind. It is re-creating our lives and doing away with the human slavery of toil. It has become the silent partner of man to be directed according to his will. Take electricity away and the result will be chaos and the destruction of the very fabric of our present civilization.

The modern electric ship is the contribution of engineers of our own generation. Twenty years ago this invisible force was applied to the driving of a ship—a small Chicago fire boat. Then came a lapse of five years and the United States navy adopted electricity as the motive power on the collier JUPITER. Another lapse of five years and electricity

The author, Frank V. Smith, is an engineer on the federal and marine department staff of the General Electric Co. This article was prepared at the request of the editor.

was driving our foremost first line battleship, the NEW MEXICO. As if to commemorate the twentieth, fifteenth and tenth anniversary of these vessels, the mighty airplane carriers SARATOGA and LEXINGTON, and the palatial passenger liner, the S. S. CALIFORNIA, were commissioned.

The story does not end here. The large ship lines of the North Atlantic are proposing vessels finer than anything heretofore built; liners more luxurious, more powerful and faster.

Turbine Electric Drive Efficient

Turbine electric drive, when considered in its simplest terms consists of the power generating plant: A turbine generator similar to those found in any central station on shore; a motor directly attached to the propeller shaft, and an operating

panel where the speed, power and direction of rotation of the propelling motors are controlled.

The starting, stopping or reversing of the propeller motor is a very simple process. The turbine generator always operates in one direction and generates current only when the field coils are excited. With the usual three-phase, alternating-current system, three wires carry the current from the generator to the motor. To reverse the propulsion machinery, excitation is taken off the generator field windings and the juxtaposition of two of the three main current carrying wires is changed. Current is again applied to the generator field windings, the flux in the motor stator windings is reversed and the propeller turns in the opposite direction. Full power is available in either direction and the operation can be ac-

completed in a very short time.

In the first place it is desirable to know the power the main propelling equipment is developing; this gives a check not usually available with any other type of propelling equipment. To measure electric power, two meters are required—a voltmeter and an ammeter. If, instead of multiplying amperes and volts together to find the watts, it is desired to simplify the method of reading power farther, a wattmeter with the readings on the face of the meter given in kilowatts can be installed. It is usual practice on electric drive ships to install all three. Now, if a ship has two main generators (one to operate the starboard propeller or propellers, and one for the port propeller or propellers) this accounts for six of the mysterious electric instruments.

It is also desirable to know how much power is being applied to the generator field windings; this calls for two more meters. Then there are propeller revolution counters, clocks and steam pressure and vacuum gauges. Thus it does not take much to make quite a formidable panel.

When turbine electric drive is applied to either a twin screw or a quadruple screw vessel, and two and four turbine generators are installed respectively, the electric, or setup combinations give greatest reliability.

In a twin screw vessel in which two turbine generators are installed, one generator is electrically connected to each propelling motor. Each propeller is, therefore, operated independently and, in maneuvering, can be reversed irrespective of the other. If it is desired to operate at reduced power at sea, both motors may be electrically connected to one generator, in which case, approximately 75 per cent maximum speed is attained.

In a quadruple screw vessel, in

which four turbine generators are installed, the permutations and combination are naturally increased. Either one, two or four generators may be used to suit the powering condition. Through the use of double motors on each propeller shaft, many more combinations are possible, and either both or one of the motors on a propeller shaft may be operated to suit the case.

The economic possibilities with turbine electric drive are the same as in a central station, because the turbine operates in one direction only and lends itself to modern steam conditions. Each particular type of ship is a study in itself. The trade route and type of cargo handled affects its fuel economy. Combined pas-

trically driven and steam being extracted from the main turbines for feed water heating. The fuel consumption on the large North Atlantic liners with the older type of propelling equipment, now averages from 0.95 to 1.3 pounds of oil per shaft horsepower hour. The present possibilities of reducing the fuel consumption on the large passenger liners through the adoption of up-to-date electrical propelling and auxiliary apparatus is, therefore, from 30 per cent to 60 per cent, according to what is being compared. Comparing one of the most recent North Atlantic liners (averaging close to 50,000 shaft horsepower with a fuel consumption of 0.95 pound of oil per shaft horsepower hour) with a mod-

Fuel Consumption—Electric Drive

Type of vessel	Designed S.H.P.	Steam pressure	Superheat Deg. F.	Lb. Fuel per S.H.P. Hr. for all purposes
Twin screw	15,000- 25,000	250	100	0.80-0.77
Twin screw	15,000- 25,000	275	200	0.75-0.72
Quadruple screw	50,000-100,000	250	100	0.76-0.74
Quadruple screw	50,000-100,000	275	200	0.72-0.68

senger and cargo liners operating in the tropics and having large refrigerating cargo holds, differ materially from a passenger liner operating in the North Atlantic, because of both the auxiliary load and the vacuum obtainable. A number of analyses lately made on different types of combined passenger and cargo vessels, taking the actual obtained operating economy of the S. S. CALIFORNIA as a basis, show that, with complete electrification, the normal expected average fuel consumption should be about as noted in the table above.

The values given in this table were calculated on the basis of the auxiliaries being almost completely elec-

trical. A modern electric liner of the same power and a fuel consumption of 0.72 pound of oil per shaft horsepower hour, the savings amounts to 124 tons of fuel oil per day. Assuming that these vessels spend 75 per cent of their time at sea, there is a saving of 34,100 tons of fuel per year. With fuel oil at \$10 a ton, modern electrical installations quickly pay for themselves.

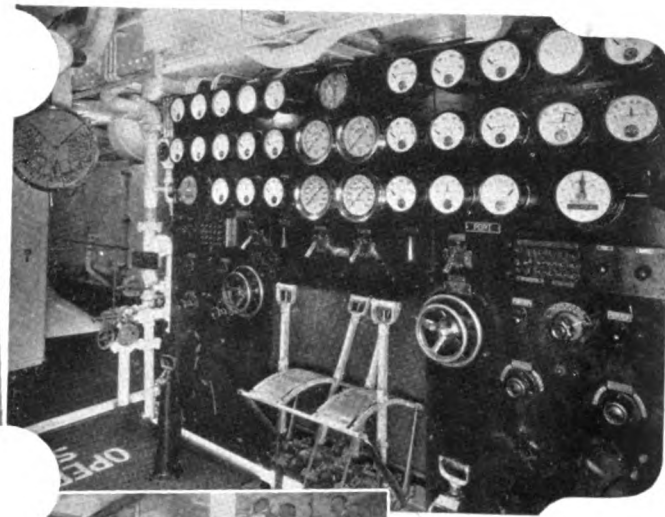
With diesel electric drive, an entirely different field of electrical engineering is entered, for direct-current machinery is invariably used, whereas, in the large turbine electric installations, alternating current machinery is used.



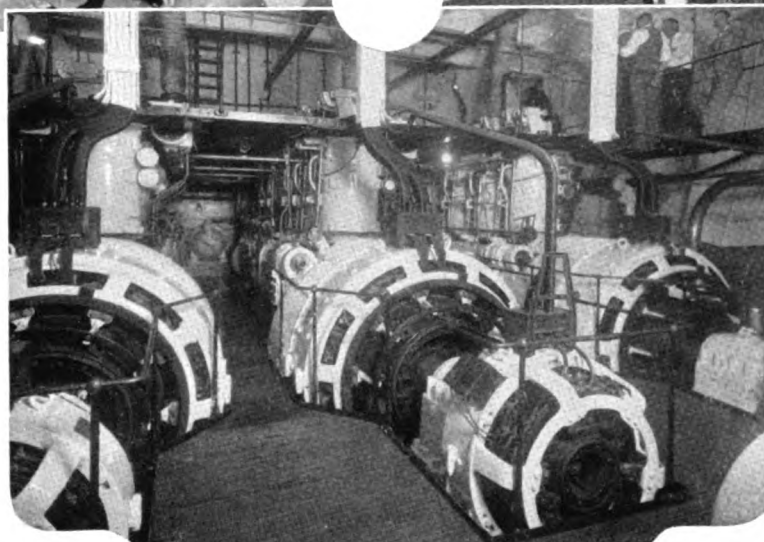
Diesel Electric Tug Chagres—Built by the Mechanical Division, Panama Canal



Above—Engine Room of the S. S. California showing motor driven circulating pumps in the foreground. In the background to the left may be seen one of the two Main Propulsion Motors directly connected to one of the two propeller shafts.



Above—Main Propulsion Control Board on the S. S. California. These instruments give to the engineer all necessary information about power developed, steam pressures, temperature, revolutions and speed. An exact knowledge of the conditions of operation is thus given.



Engine Room of the Diesel Electric Drive Tanker Sharon

Diesel electric drive combines the high fuel economy of the diesel engine with the great flexibility of electric apparatus. It differs materially in its characteristics from diesel direct drive as it permits the selection of small, compact, relatively high speed engines which operate in one direction only. Starting air is not used during maneuvering and all reversing gear is eliminated.

Propeller and engine speeds do not have to be compromised because they are coupled together electrically; field control on both the generator and propelling motor allows both the voltage and current to be altered at will, and any speed or torque combination desired can be obtained. It is an electrical form of variable speed reduction. Through these controls, the propeller speed can be so altered as to absorb just full power from the engines; in the same manner overloads can be prevented.

Diesel electric drive has established itself very quickly in the marine field as one of the major forms of propulsion. Because of the great flexibility with which the power could

be controlled and directed to the propulsion and auxiliary needs, this form of drive was first considered with respect to its use as a general utility power plant on ships of special types.

The first successful commercial installation of this type of drive in this country was on the fishing trawler *MARINER* which was placed in commission in 1919. The power in this case was used for propulsion at sea and for maneuvering and auxiliary power while at the fishing banks.

Diesel electric drive has since been applied to many different types of craft and, in each instance, many excellent reasons can be given for its use and selection. The list of vessels so equipped now becomes too lengthy to present in an article of this kind, and even a list of the types of vessels becomes long in itself. It has been applied to ferryboats, tugs, dredges, yachts, fire boats, cutters, passenger and cargo vessels and stern wheel river tow boats with great success.

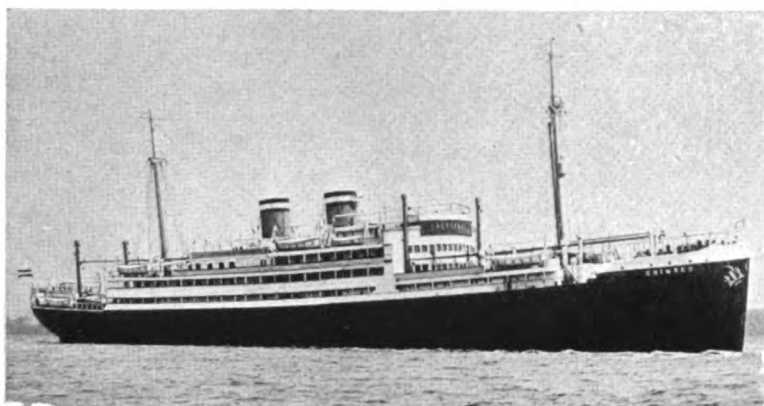
Late additions include a packet boat and three light ships.

Electric power has one very good attribute; that is, it is easily controlled. With the up-to-date magnetic type of control, motors can be started and stopped by means of a push button or a switch more safely than they can be with the older type of dial type starting rheostat. The location of push buttons is of no consequence either to the motor or push button. Schemes can be worked out for each installation which give the highest degree of operating convenience. The main propelling power is just as easily controlled, from the operator's point of view, as that of the small motor. An operator's stand resembling an engine room telegraph is almost invariably placed in the pilot house, which operates the combined ahead, stop and reverse switch. This control functions directly without relay of signals, is immediate in its effect and also gives any speed graduations desired.

Electrification is fundamentally sound; because of its great economic possibilities, it is bound to play a great part in the future development of our merchant marine.

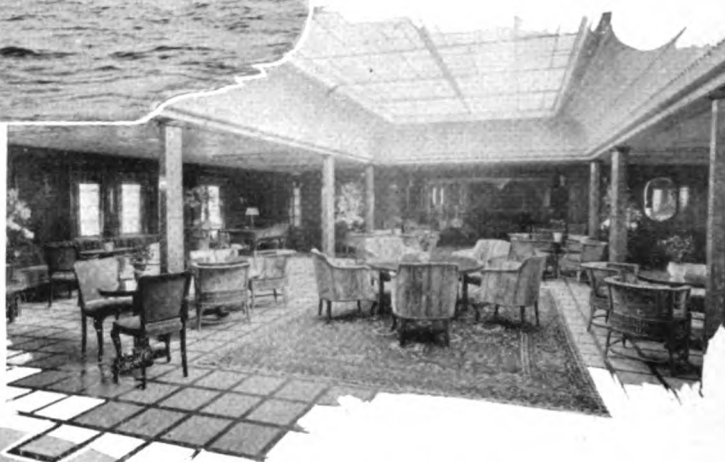
1878 1928

New Liners Are Diesel Powered



MAGNIFICENT motorships Orinoco and Magdalena for the West Indies and Central America services of the Hamburg-American Line. They are 456 feet long and are driven by two diesel engines of 6500 horsepower operating twin screws—Passenger accommodations combine luxury and convenience.

THE first class lounge is commodious and artistically furnished—The furniture is of excellent design and quality—The lighting is so arranged that disagreeable glare is avoided.



GLIMPSE of the intermediate dining room showing the small table arrangement for the comfortable accommodation of 100 passengers—Lighting facilities have been worked out with particular attention.



THE first class dining room offers the last word in artistic design—It extends through two decks and is connected with the lower part of saloon by the wide staircase shown in the background—The tasteful furnishing of this room is of distinctive beauty.



Revival of Our Merchant Marine Depends on Private Initiative

By John A. Penton

NOW at last after more than a quarter of a century of contention and struggle and the expenditure of a mammoth amount of energy and effort on the part of many citizens, business men's associations, and political organizations, there has been passed a law that has for its purpose the building up of an American merchant marine.

Whether those great leaders who gave so much of their time and effort to this work, Senators Frey, Gallinger and Hanna in the senate, Congressmen Humphrey of Washington, Fassett and Dwight of New York, Minor of Wisconsin, and Myron T. Herrick, all of whom with two exceptions have passed away, would endorse and approve the measure that has just been adopted and the method of operation, is a question that could probably not be answered in the affirmative.

This is beside the question, however, the fact is that we now have something and it will be for the historian of the future to determine whether judged by the cold, unimpassioned standards of the economist, the result will justify this particular method to bring about the desired end.

The whole American merchant marine proposition and the carrying out of the plans decided upon are apparently permanently placed under the control of the shipping board.

If the board is able to administer wisely the enormous sum placed at its disposal by a congress, earnestly desiring to build up our merchant marine it will constitute another world of the greatest possible praise for having ably used the power of the government to erect and operate a public utility in a satisfactory and economical manner.

In 1905, 1906 and 1907, when the merchant marine proposition of those days, known as the Gallinger bill, aroused so much bitter feeling and contention between political parties, it was approved unanimously by a patriotic and far-seeing senate and defeated in a strongly Republican congress by a coterie of Republicans. This measure which simply author-

ized a modest amount of mail pay to American built and American operated ships for carrying American mails on the outgoing voyage, was as much as its proponents felt would be needed to accomplish a wonderful result.

One of the most important organizations of that day working for this measure was the Merchant Marine league, of which the late Harvey D. Goulder was president, Myron T. Herrick, vice president, and Col. J. J. Sullivan, treasurer.

This measure at that time provided that the small extra amount over and above the regular rate in exist-



John A. Penton
Chairman of The Penton Publishing Co.

ence in the country derived by the postoffice from carrying foreign-going mail matter should be given to the postmaster general for use in making contracts with American-built ships operated by Americans in foreign trade, carrying American passengers, American express and American freight to those countries with which we were then in close maritime contact. It was not contemplated then to go into competition with the larger and faster boats that carried our mails to northern European countries, but only to the Mediterranean, South America, the Orient

and to Pacific ports, and it is a travesty on the lack of vision of the congress of those days when this modest measure met with hysterical denunciation from many politicians and many publications that today are without unfavorable comment, approving without any criticism a measure gigantic in its proportions, as expensive in its terms and as far-reaching in its influence as the measure just signed by President Coolidge.

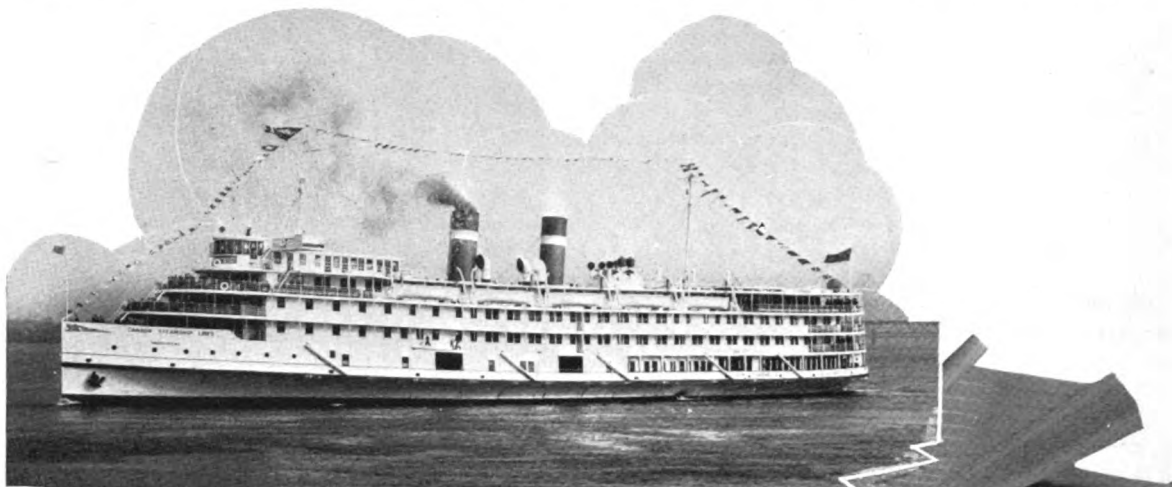
It was originally determined by a nonpartisan commission of the senate and house that held meetings of a widely advertised character under the leadership of Senator Gallinger at principal ports on the Atlantic and Pacific as well as at a number of important centers in the interior that there was a widespread feeling for restoring the historical policy of discriminating duties. This policy had been successful in the early days of the republic before numerous treaties of commerce had been established between the United States and many foreign countries.

At various times provisions of that character have been written into American law but have never been put into operation by the executive branch of the government because of reluctance to disturb existing treaty relations and the possible disastrous effect of reprisals of one kind or another. One of the reasons why a method of this character was impossible came through the discovery that 43 per cent in value and 60 per cent in bulk of our imports were on the free list in 1903. Consequently, a measure that depended for its success upon free importation or a reduced tariff rate on imports in American bottoms would not be workable under the circumstances with such a large volume of goods coming in entirely free. Therefore, the discriminating duty policy or program was eliminated and fell to the ground. Free registry of foreign-built ships was another plan, but this measure never had an extensive following as it meant the putting out of business of American shipyards, the utilizing of foreign labor, some of it from the Orient, and many other repugnant

(Continued on Page 128)

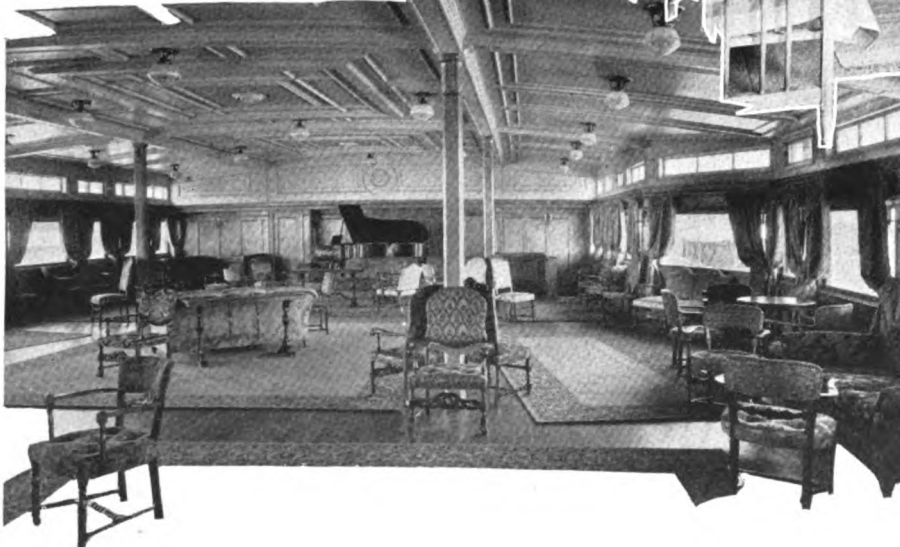


New Steamer for St. Lawrence



UPPER—Steamer Tadoussac, a sister ship of the Quebec, soon to be put into commission by the Canada Steamship Lines—These magnificent vessels are 359 feet overall, 70 feet beam over the guards with a molded depth of 21 feet.

RIGHT—Partial view of one of the staterooms, all of which are outside rooms, showing modern twin beds to replace the bunks of other days—The artistic lighting effects and general scheme of decoration are well worked out.



LEF—The music room is fitted with an excellent hardwood floor which may be used for dancing—The rugs are Khorassan in two shades of blue which contrast pleasingly with the oak walls which are finished in silver gray—The ceiling is of cream color and is fitted with overhead lighting arrangement.

Some Past and Present Leaders

Brief Sketches of a Few of Those Who Have Contributed
With Distinction to the Onward March of Marine Affairs

By E. C. Powers

HO INDUSTRY is stronger than the individuals who devote their talents and energy to its development. In this respect in the past 50 years the marine industry, made up of the science of naval architecture, shipbuilding and shipping, has been singularly fortunate. Its leaders are men of rare talent and their contributions have been of the greatest importance in the remarkable progress made during this period.

Donald McKay

THERE was born in Shelbourne, Nova Scotia in 1810 a child who was destined later to become one of the greatest, if not the greatest of the world's shipbuilders. When still quite young, Donald McKay journeyed to New York where he absorbed the fundamentals of the trade at which he early in life became the master craftsman. Having completed his period of apprenticeship in the country's greatest city the young tradesman traveled to Newburyport, Mass.

Establishing himself as shipbuilder Donald McKay met with success, so much that he was soon able financially to purchase a shipyard at East Boston, Mass. Then came the glorious clipper ship!

Without any question, these ships were the most beautiful, the most seaworthy and the swiftest vessels ever to sail the seas. So fast were they that all crossing time records were broken. In fact, the speed of these clippers is exceeded today by only our most modern ships. In those days the clipper ships could outsail and outweather any other ship afloat. One of them—*LIGHTNING*—holds the world's sailing record—436 miles in one day, better than 18 miles an hour.

With their great towering masts the square riggers—*SOVERIGN OF THE SEAS*, *FLYING CLOUD*, *GREAT REPUBLIC*, *WESTWARD HO*, *LIGHTNING*—placed the United States in the front rank of maritime powers. In competition with the strongest sea power in the world these ships gained for their country twenty-five years of supremacy in ocean commerce. For the most part this was the consequence of Donald McKay's creative genius.

During the Civil war Donald McKay constructed many war vessels for the Federal government. Among these were monitors and gun boats, including the *ASHUELOT* and the sloop-of-war *ADAMS*.

Strictly speaking, Donald McKay does not belong in the 50-year period of 1878-1928. The active years of his life had terminated before the beginning of this half-century of marine history. His influence on the other hand, after his death in 1880, upon all subsequent shipbuilding and the radical transformation of ship design brought about by his genius are more than enough to warrant including his name in this record.

In order to regain her lost supremacy of the sea, Great Britain concentrated her boundless shipbuilding resources and facilities upon perfection of the iron ship, which in time proved that in the cargo trade as well as passenger, safety is of much greater importance than speed. The harder-than-wood material used in ship construction though not directly developed by Donald McKay, came as the consequence of his world famous clipper ships and on that account, if on no other, his contribution to the posterity of shipping the world over has been of lasting and inestimable value.

Charles H. Cramp.

A NAME which suggests triumphs in ship building and signifies fulfillment of the requisites of greatness is that of Charles H. Cramp.

Mr. Cramp was born May 9, 1828 at Kensington, now a part of Philadelphia, on the Delaware river and spent his childhood in the atmosphere of naval architecture and shipbuilding, his father being a shipwright. His education began in the common schools in the vicinity and when he was about 14 years of age, he entered the old Central high school. At the end of a term of three and one-half years spent under the tutelage of Professor Boche—a foremost authority of his time on the science of applied mathematics and physical sciences—the young student left school and went into the shipyard of his uncle, John Byerly. In 1846, after the practical

experience in his uncle's yard, he entered his father's shipyard.

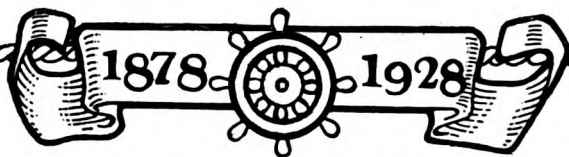
As a shipbuilder his first undertaking about 1846 was the design of the first propeller tugboat ever built in the United States. Many vessels were built at the Cramp yard about this time for use in connection with the operations of the army under General Scott against Vera Cruz.

Between 1840 and 1860 shipbuilding became more of a science by the transition from wood to iron construction. Discovery of gold in California, the Crimean, Franco-Prussian, and our own Civil war all combined to create great activity in American shipbuilding. It was, however, during the period of the Civil war that Mr. Cramp's genius became nationally prominent.

Low ebb of naval equipment awoke the nation to the need of building up the navy. The first vessel of this program was designed by Mr. Cramp in 1861 and was completed in the marvelously short time of six months, being named *NEW IRONSIDES* and was in action at Fort Sumter eleven months after the contract had been signed and from that time until the close of the war the navy benefited by his great skill and experience in construction and repair.

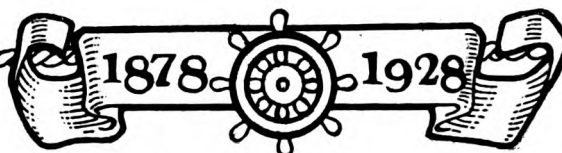
Subsequent to the end of the Civil war, engine building was added to the work of the Cramp company. The first achievement in this enterprise to attain historical significance was the design and construction of the first compound marine engines built in America, which occurred in 1872. Following them in 1873 and 1874 the *PENNSYLVANIA*, *OHIO*, *INDIANA* and *ILLINOIS* were constructed complete with machinery, at the Cramp yard.

In 1885 William Collins Whitney became secretary of the navy and his sole object in accepting the portfolio was to promote public welfare. Mr. Cramp's experience and professional ability combined with great practical knowledge lead to his summons by the secretary to aid in the program. Not one of the 12 ships constructed at his yard exhibited any but most excellent records. These 12 vessels built at the Cramp yard exceeded in number the total (10) built

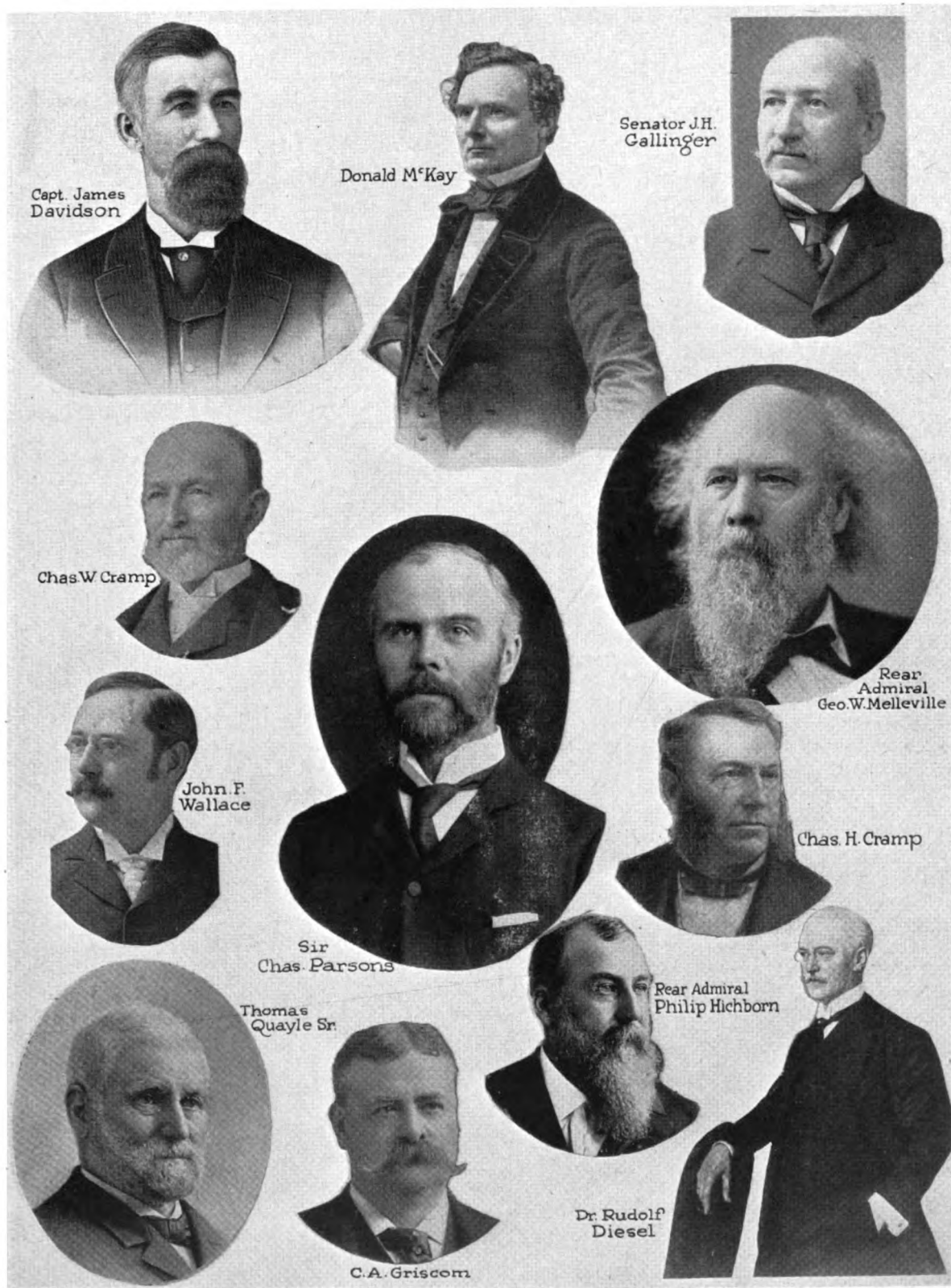


Notable Men in Marine Affairs





Makers of Maritime History



Capt. James Davidson

Donald M'Kay

Senator J.H. Gallinger

Chas W Cramp

Rear Admiral Geo. W. Melville

John F. Wallace

Chas. H. Cramp

Sir Chas. Parsons

Rear Admiral Philip Hichborn

Thomas Quayle Sr.

Dr. Rudolf Diesel

C.A. Griscom

by all other American builders combined, including the navy yards.

The literary contributions of Mr. Cramp to the arguments for a new navy and the upbuilding of the merchant marine were of great value in molding public opinion. Mr. Cramp's later occurred on June 6, 1913.

Admiral G. W. Melville

IT HAS been said by those who knew Admiral George W. Melville that he was really one of the old Vikings come into being some thousand years after the last of the historic rovers had disappeared. In common with these intrepid mariners Admiral Melville possessed great will power, extreme tenacity of purpose, absolute fearlessness, and all the qualities essential to leadership.

Born in New York City, Jan. 10, 1841, he was educated at Brooklyn Polytechnic institute. After graduation, he entered an apprenticeship course with the engineering works of James Burns in Brooklyn, where he became familiar with the practical phases of his profession. At the outbreak of the Civil war he entered the navy as a third assistant engineer, serving with distinction on the MICHIGAN and DAKOTA as well as other war vessels, playing an important part in the capture of Norfolk.

After the war the efficiency and resourcefulness of Admiral Melville in sea duty made all the older officers eager to have him on their staff. In 1873 he volunteered as engineer officer on the yacht, TIGRESS, chartered for a relief expedition to the Arctic to rescue a portion of the crew of the stranded POLARIS. Captain Greer, U. S. N., in command of the expedition, stated officially that in spite of the miserable condition of the machinery, Admiral Melville's great resourcefulness combined with thorough practical knowledge were solely responsible for their being able to carry on at all.

The story of the ill-fated JEANETTE, which was locked in the ice of the Arctic for two years, further emphasized the young engineer's qualities. Lieutenant De Long, in command of the expedition, said that if Melville's persistence in landing and making surveys in the face of superhuman obstacles was not "a brave and meritorious action it would not be from any failure on my part to make it known." Very few members of that expedition returned alive. Later Melville was chief engineer of the THETIS, the relief ship for the Greely expedition.

Melville was senior inspector at Cramp's yard in the years centering

around 1882 in the program of building the "new navy." Melville at that time was responsible for stopping the practice in this country of importing ship designs from Great Britain. He and his associates designed the machinery for the SAN FRANCISCO which later proved one of the most successful of the early ships.

In 1887 Admiral Melville was appointed engineer-in-chief of the navy by the President, which office he held for 16 years—the longest career of any bureau chief in the history of the navy.

Outstanding as evidence of his great engineering ability are the engines of the first battleships, of the armored cruisers NEW YORK and BROOKLYN and the 3-screw flyers COLUMBIA and MINNEAPOLIS which were the fastest large vessels in the world of their time. These ships introduced watertube boilers.

After Admiral Melville's retirement from active service in 1903, he originated the reduction gearing which adapted steam turbines for use as marine propulsion units. He remained as a consulting engineer from 1903 until his death in 1912.

Clement A. Griscom

PROBABLY no man was more closely associated with American shipping during his lifetime than Clement Acton Griscom. From the earliest years of his active life in the marine field until the time of his retirement he constantly held the best interests of shipping at heart and worked for its development.

Mr. Griscom was born March 15, 1841, began his career in 1863 when he was made a partner in the firm of Peter Wright & Sons, shipping merchants. With this company he gained invaluable knowledge of the shipping industry and rendered noteworthy service to the concern, greatly increasing its activities.

In 1871 he began the operation of the American line with the only ships flying the stars and stripes on the North Atlantic, the INDIANA, PENNSYLVANIA and OHIO. These vessels were remarkably well designed and strongly constructed. It is claimed for Mr. Griscom that during the 40 years of his operation of the line, he never lost a ship, passenger or bag of mail.

A new American line with Mr. Griscom in charge was organized and placed in operation in 1888. President Harrison raised the American flag on the steamships NEW YORK and PARIS. Some time later the ST. LOUIS and ST. PAUL were built at the Cramp yard for this newly formed

line, for fast transatlantic service. In 1901 as a result of his idea that consolidation would insure the best handling of passenger and freight traffic on the North Atlantic he realized his life-long ambition, the amalgamation of various shipping companies under the title of International Mercantile Marine Co. In this venture he was associated with J. Pierpont Morgan.

The International Mercantile Marine Co. absorbed Mr. Griscom's companies, as well as the White Star line, the Atlantic Transport line and the Leyland and Dominion lines. Mr. Griscom served as president of the International Mercantile Marine Co. until 1904 when he resigned to become chairman of the board of directors.

From the time of the founding of the Society of Naval Architects and Marine Engineers in 1893, until 1903, Mr. Griscom was the society's president. As stated in the minutes adopted by the society at the instance of his death, he "freely extended his great energy and ability to the establishment of it as a permanent influence in the field of marine engineering and shipbuilding."

Boundless energy, unlimited capacity combined with great power, forcefulness of purpose and lofty vision describe most adequately this man who aided so greatly in the commercial development of the nation and in the perfection of transportation on land and sea.

Sir Charles A. Parsons

SIR CHARLES A. PARSONS was born in London, June 13, 1854, the fourth son of the third Earl of Rosse, of Birr Castle, Parsonstown, Ireland. His education was received partly from private instruction at home and later at St. John's college in Cambridge at which institution he was graduated eleventh wrangler in 1876. While still at college, the idea of a rotary engine first occurred to him.

His scholastic career ending with the completion of his studies at St. John's college, he entered the Armstrong works in Elswick serving as an apprentice there until 1881, when he joined the experimental staff of Messrs. Kitson of Leeds where he remained until 1883. As a result of this experience he was in 1884 made a partner in the firm of Messrs. Clarke, Chapman & Co., which then became the firm of Messrs. Clarke, Chapman, Parsons & Co.

Electricity had come to occupy the thought in engineering circles at that time and Sir Charles conceived the
(Continued on Page 130)

LIGHT

Fifty Years of Progress in Applying Electric Lighting to the Ships of the World

By R. G. Slauer and Roger A. Lea

THE fifty year anniversary of the MARINE REVIEW coincides almost exactly with the development of electric light for marine service. Just a few years before 1878, the first commercial use of electricity for lighting was discovered—the arc lamp. A year later, 1879, saw the invention of the incandescent lamp.

The electric arc was the first invention that enabled man to project light—to throw it in a beam to illuminate the path he desired to take.

The success in using arc lamps to make night navigation safer from the outside made them desirable for greater safety and comfort inside the ship. The size of the arc lamp prohibited this except in the place where perhaps it was needed the most, in the engine room.

In 1879 Thomas A. Edison, working at Menlo Park, N. J., succeeded in

This article was prepared at the request of the editor by Roger A. Lea of the Artistic Lighting Equipment association and Richard G. Slauer of the Edison Lamp Works, Harrison, N. J.

enclosing a piece of carbon thread in a glass tube, exhausting the air and then passing electrical energy through the filament to make it glow and give off light. It looked promising and the Edison Electric Light Co., was founded by several prominent men to back Edison in his researches.

At that time the steamship COLUMBIA, destined for the Oregon Railway and Navigation Co., was under construction at Chester, Pa., and was almost completed. This ship steamed to New York and the Edison Electric Light Co. received its first contract to install a lighting system. Four dynamos were installed, run from two overhead countershafts driven by a pair of vertical steam engines. Each dynamo had a capacity of 60 lamps, or about 6 kilowatts (8 horsepower), one dynamo being used as an exciter for the other three. The ship was equipped with 115 lamps and the plant was started on May 2, 1880. The COLUMBIA sailed around the Horn to San Francisco, where she arrived in July. The advising engineer of the

Navigation company reported that the installation was a complete success. The original installation ran for 15 years, when the ship was overhauled and a more modern plant installed.

The value of the incandescent lamp was quickly established for marine service. The greater amount of light obtainable, the ease and flexibility in using it, the comparative freedom from fire, and the decreased maintenance attention made it almost ideal. Naturally, there were early troubles in the use of incandescent lighting systems. The earliest lamps were fragile and somewhat expensive. But as the years passed, lamps were made more reliable, cheaper and to obtain more light for a smaller current consumption. There was also some trouble about the reliability of the whole system during an accident. One or two big marine disasters, the ELBE and the DRUMMOND CASTLE in European waters for example, were attributed in part to the total failure of the incandescent lighting system



First class library on California, the largest commercial steamship to be built under the American flag

after a collision. This was caused by the lack of an emergency lighting system, and by the not entirely dependable dynamo construction. But in the first 15 years, up to 1895, these troubles had been largely overcome and the incandescent lamp was firmly established.

One of the early defects of the incandescent lamp was its limitation to sources of low light output, thus eliminating its use in searchlights and requiring a large number of sockets to light an area of any size. The problem of the searchlight was solved

wire. The use of tungsten gave a greater amount of light for a given current consumption and enabled higher wattage lamps to be made. In fact, drawn tungsten was so much more efficient than previous types of lamps that it was economical to scrap most of the lamps that were actually in sockets. Drawn tungsten lamps had one fault however, for marine service. This was that they were a little more fragile than carbon lamps and did not stand up as well for rough service work. Therefore, they were not at first

used where vibration was considerable, as in the engine room, and for hand portables; that is, on extension cords. But after a year or two of improvements, they were found to be perfectly satisfactory everywhere except for hand portables.

The greatest improvement, next to the adoption of tungsten, in incandescent lamps since they were invented by Edison was made around 1913. This was the use of an inert gas in the lamp and, at the same time, coiling the filament like a spring. Gas filled lamps were far more efficient than vacuum and could be had in larger sizes. In fact, at first only 1000 and 750-watt lamps could be made. Today, however, gas filled lamps are procurable down to 50 watts.

The wide range of sizes made the incandescent lamp supreme for ship lighting and especially since electric generators and storage batteries were also being tremendously improved, it began to be used for even the smallest size craft. Greater fields were open to the designer and architect in the matter of light for decoration as well as light for utility. The more efficient higher wattage tungsten lamps are exceedingly bright and, therefore, in many cases quite glaring. Especially is this true on shipboard where the decks are quite low. Much in the line of proper design is still neglected today. Many recent installations are by no means satisfactory from a lighting standpoint. Poor distribution of light, glaring units, insufficient intensity and inharmonious and ugly fixtures often spoil the magnificent interiors of our de luxe liners. Two other improvements in incandescent lamps are worthy of mention here. The first, around 1921, was the invention of the tipless lamp. It was long recognized that the tip was a weak link in the chain of successful service.



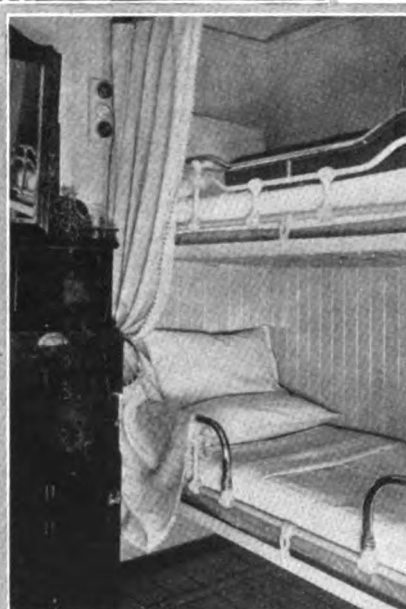
Above—Dining room of the Kaiserin Auguste Victoria—The general lighting is by individual table lamps

Right—Stateroom on the Princess Anne, 1911—Illumination is by a single sixty watt ceiling lamp

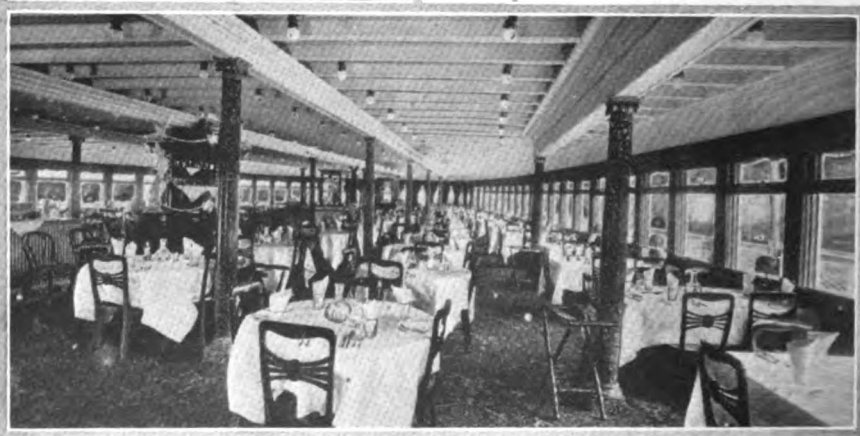
by increasing the performance of arc lamps. Even today the higher powered searchlights are arcs, although for merchant marine service incandescent lamps are entirely satisfactory.

The necessity of using a great number of sockets brought about three ways of lighting the engine rooms; the use of this great number, the use of arc lights and, after 1900, the use of Cooper-Hewitt mercury vapor lamps. The arc lamps, while giving a great quantity of light, were quite glaring to the eyes of the workers, threw very harsh shadows and were constantly flickering. The Cooper-Hewitt lamps were appreciably better from a lighting standpoint.

So matters stood till about 1910, the changes being continual improvements in the efficiency and reliability of the lamps and the greater use of reflectors for more scientific control of the light and for added beauty and comfort. At this time, a new type of incandescent lamp was rapidly coming into favor for use on shipboard; a lamp in which the carbon filament was replaced with drawn tungsten



Below—C. W. Morse—Best lighted river steamer of the period of 1911—Lighting by 16-candlepower lamp



Some were broken when shipped, many when installed, and many during actual service—especially in places where the lamps were comparatively low, such as on shipboard, and the occupant of the room, or worker in it, frequently knocked the lamp. The elimination of the tip did away with most of this breakage.

The second improvement of note was the designing of a special rough service lamp for hand portables in 1926. The old smoky, kerosene bulk-head lamps and petticoat lamps, burning the extract of hog fat, were the last to give way to electric light for use in cleaning boilers, in coal bunkers and around machinery in general. And then after tungsten began replacing carbon, again the older type remained because they were more rugged than the new. But today it is not necessary to use carbon—the rough service lamp is fully as strong and far more efficient. This lamp has a great use on shipboard because it is impractical to have general lighting of sufficient intensity in and around all the massive machinery.

Perhaps a few notes on the modern way of ship lighting would not be amiss here. The larger ships are regular cities, all the necessities and luxuries of the landsman are expected on shipboard. Therefore, in general there are few differences. In the engine rooms—the factory on water—in the galley, we have the same necessities of adequate intensities of light plus proper distribution of light with glaring light sources eliminated. In the social halls and the staterooms, we have the home and hotel of the land, where the above factors are important, but in addition the decorative

element plays an equally important part. To a certain degree, the question of lighting is purely one of economics. The public when paying a top price expects all the comforts possible. Where a lower price is charged, less elaborate equipment will be found. Therefore, the various divisions, first class, second and third, would be fitted with lighting equipment in accordance with the general equipment of each class.

In the saloon, library, smoking room and similar places, the decorative element is predominant. If space permits, massive ornamental fixtures

are used. The chandelier type is seldom used, because the continual vibration and swaying quickly ruins them and disturbs those using the light. The only remedy is to use very strong wire to brace them and this is not always satisfactory. No set rules can really be laid down for the lighting of these portions as the keynote of an artistic installation is originality in harmony with the treatment of the rooms. Bright light sources, particularly against dark backgrounds, are glaring and annoying. As most decorative fixtures are relatively inefficient, sufficient wattage

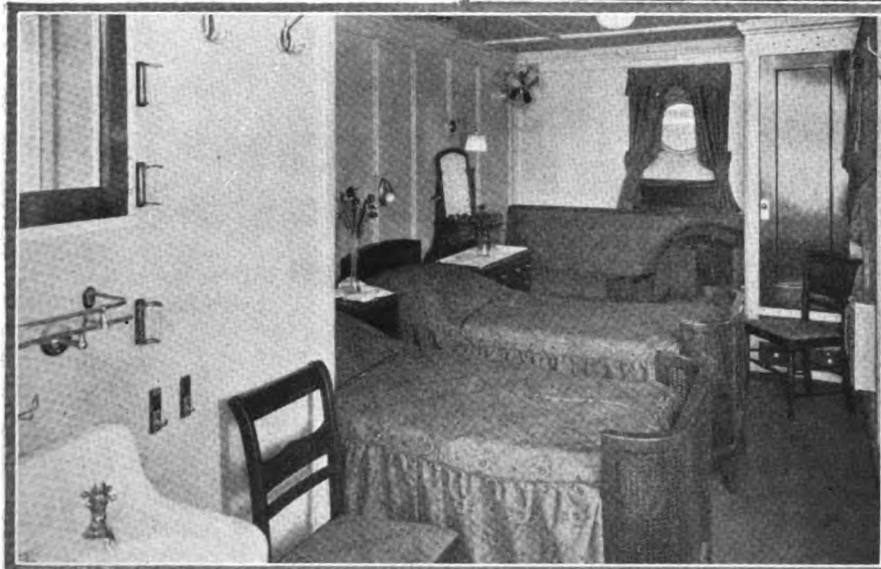


Above—Bedroom, first class, on the California showing excellence of the general lighting arrangement



Left—Ladies' writing room, Kaiserin Auguste Victoria, about 1911—Decorative effect splendid

Below—First class stateroom California—General lighting unit close to ceiling—Convenient mirror and reading lights



must be used to get a desirable intensity of illumination. Where ceilings are low, it is necessary to employ a number of smaller units to get the best distribution.

The dining room is almost similar to restaurants on land. Two systems of lighting are employed; general illumination from ceiling units alone and illumination at each individual table from a table lamp supplemented by a low general intensity from overhead. Many times, both here and in the social halls, we encounter very good examples of cove lighting, lighting from glass paneled ceilings, wall brackets or floor pedestals. It is wise to remember that wall brackets are invariably at the height of the average eye, so that particular care must be taken to properly arrange them.

The stateroom is essentially a bedroom and dressing room. Therefore, besides general lighting from a unit in the center of the ceiling, there should be additional light at the bedside in the form of a reading lamp, and additional light for the mirrors at the dressing tables and lavatory.

In almost every first and second class room, these will be found; in the third class, a single overhead unit only is most often installed.

With these few general observations we conclude this brief history of lighting. There has been a tremendous advance in the illuminants available for shipboard service in the last 50 years. But this advance has

been more in manufacture than in application. A majority of ships today are poorly lighted from an intensity and distribution standpoint. From a decorative standpoint they are far better. This shows up especially well in the working areas of the ship. Here, where the decorative element is unnecessary and therefore omitted, it is easily apparent that the

equipment is not entirely satisfactory from a utilitarian standpoint. But with a quite satisfactory illuminant available, easily controllable, comparatively cheap, easily adaptable to all sorts of decorative schemes, we look forward to a great advance in ship lighting, not in the next 50 years, but in the next ten, and by this much increasing the efficiency of operation.

Advance in Marine Engineering Rapid

By W. E. Thau

THE last fifty years have witnessed a remarkable development in marine engineering. Steam pressures have been increased from about 60 pounds to 550 pounds and the following types of propeller drives have been developed, introduced and perfected;—triple and quadruple expansion engines, direct drive turbines, geared turbines, diesel engines, turbine-electric and diesel-electric drive. Boilers, auxiliaries and energy saving devices such as economizers, feed heaters, evaporators, air heaters, superheaters and vacuum apparatus have been applied and brought to a high state of development. The use of electric auxiliaries has shown a marked improvement in the overall economy in the case of all types of main drives.

The reciprocating steam engine was used without interruption in the period between 1878 and about 1885. During this period the reciprocating engine underwent a normal course of development not hastened by competition. The chief developments were increase in pressure, rotating speeds, and piston speeds. The period of 1870 to 1900 saw the introduction of the triple and the beginning of the quadruple expansion engines. Boilers were also considerably improved during this same period, and pressures were increased from about 70 pounds to 250 pounds with some talk of 400 pounds. It is the oldest practicable power device for driving a ship and will undoubtedly remain while some of its more recent competitors come and go. However, for the general field of marine propulsion its wings have been clipped.

The introduction of the direct drive marine turbine which began in 1894 served as a goad to improve the performance of the steam engine. The improvements were not sufficient to ward off the turbine, however, even

though the direct drive form of turbine was not all that was desired.

When the direct connected turbine was first applied to marine propulsion in 1894 the system proved to be successful, even though with this method neither the turbine nor the propeller can be operated at their most efficient speeds and the result is a compromise. However, for large ships the system proved more economical and more practicable than the reciprocating steam engine. A large number of installations have been made, the latest of any importance being on the S. S. ISLE DE FRANCE.

The direct drive arrangement proved to be only a stepping stone for the economical turbine installation. British and American engineers realized that a reliable means had to be devised for operating the turbine at its efficient high speed and the propeller at its efficient low speed. George Westinghouse initiated the marine geared turbine in this country soon after 1900 and in 1906 built an experimental gear. In 1909, the Westinghouse company built and tested a 6000 horsepower marine geared turbine unit which was subsequently installed in the United States collier NEPTUNE. In 1910, the Parsons company of England installed a geared turbine drive in the VESPASIAN. Since that time there has been a remarkable expansion of this form of drive, particularly in the United States.

Diesel Engine Development

Although the early stages of the diesel engine development took place about 1890, it was not until 1903 that it was applied to marine propulsion. About 1910 it began to make its appearance as a real competitor of the steam drives and, needless to say, it has made considerable progress. Today it is an important factor in the marine field. The diesel engine, like all other important de-

velopments, has undergone considerable revision and improvement in details.

The inherent performance characteristics of a diesel engine are relatively inflexible when compared with steam drives. In order to take advantage of the high fuel economy and still provide a plant having the full flexibility required in certain types of ships, and to improve the reliability, cost and general performances, the diesel electric drive was introduced in 1920. The diesel electric form has many outstanding advantages to commend its use where diesel power is applied, and it is felt that future developments of diesel engines will be of such character as will permit larger drives in the electric form than in either the direct connected or geared form. There are now upward of 85 diesel electric drives in service.

Following the earlier developments of the geared turbine, turbine electric drive made its appearance in 1911. The turbine electric drive is a perfectly logical arrangement and possesses some distinct advantages for certain types of ships. In economy performance it is very nearly equal to that of the geared turbine for the same steam conditions. In the arrangement of units and control it is extremely flexible. The relative application of turbine electric and geared turbine drive is largely a question of economics in which first cost is the prime factor.

The progress made by the diesel engine has had a direct beneficial action on the adherents and advocates of turbine drive. Until recently, the steam engineers were apparently satisfied to adhere to relatively low steam pressures and temperatures. However, the highly competitive position attained by the diesel engine has caused further improvement in the turbine plant in the nature of higher pressures, higher temperatures, elec-

(Continued on Page 128)

The author, W. E. Thau, is director of marine engineering for the Westinghouse Electric & Mfg. Co. This article was prepared at the request of the editor.

A Record of Service--1878-1928

Account of Growth and Expansion of Marine Activities as
Chronicled in the Pages of Marine Review Since its Foundation

SPANNING the half-century embraced in the history of the modest rise but amazing development in the Lake Superior iron ore, coal and grain trades; the founding of and expansion in both ocean and lake shipyards and docks; the vicarious but hopeful congressional efforts to revive the American merchant marine; after two attempts since the Civil war, the establishment and training of a competent navy; the expensive but wonderfully productive improvement of inland waterways such as the Mississippi and Ohio rivers; further development of the St. Lawrence river and the Hudson river as outlets for the Great Lakes products to the Atlantic ocean and outside world; the accompanying rise of inland villages and hamlets into metropolises such as Chicago, Cleveland, Milwaukee, Detroit, Toledo, Toronto, Montreal, Duluth, Minneapolis and the swarm of expanding smaller cities such as Erie, Marquette, Ashland, Wis., the Soo, Gary, Ind., Saginaw, Port Huron, Sault Ste. Marie, Ont., Owen Sound,

Port Arthur and Fort William; and the vast financing and banking expansion as well as the rise of tremendous industrial and commercial units growing out of and accompanying these marine developments—all these amazing events and many other marine affairs concerning the ocean merchant marine are embraced in the merest glance at the fifty-year history of MARINE REVIEW which has ever been part of them.

Founding of *Marine Record* at Cleveland in 1878 laid the broad and firm base upon which was built MARINE REVIEW. Proudly at its editorial masthead it carried the legend: "A Journal Devoted to Commerce, Navigation and Science." For five years its offices had been at 171 Superior and 136 Bank streets; but in April, 1883, it removed to the Bratenahl block on South Water street. All of these and many other buildings have been swept away within two years to make room for the Union Terminal railroad station, a magnificent structure, now building on Cleveland's public square.

As Frank Houghton, then editor and proprietor, said in a cordial editorial note when removing to the Bratenahl block (which he misspelled into "Bretanal"): "Our offices will be nearer to the docks and very handy to vessel men whom we shall be pleased to see at any time."

Evidently Editor Houghton did not share in the misgivings of some of his readers as to the permanence of his venture. In the issue of his weekly paper dated Jan. 6, 1883, he said editorially: "The birth of *Marine Record* marked an epoch in the history of journalism in the West," and although some had openly predicted its failure, he had taken no notice of such prophecies "and had pushed forward steadily," just as any courageous and far-sighted editor would do. *Marine Record* was then a four-page magazine with colored cover, type-page 9½ x 15 inches, four columns to the page, the last one carrying a sprinkling of advertising. Proudly it had been given a new dress, and an innovation announced was the printing of pictures of ships,



men, docks and equipment for the excellence of which service *MARINE REVIEW* always subsequently has been noted.

Alanson Wilcox, afterward noted preacher in the Christian church throughout northeastern Ohio, became editor and proprietor as noted in the issue of May 26, 1883.

Col. A. A. Pomeroy became editor and proprietor on Sept. 6, 1883, one of the ablest journalists in the Middle West. He had been employed by the *Cleveland Leader* since 1866, later becoming night editor, and when he bought *Marine Record* he continued his night work with the *Leader* in order to obtain needed capital. In 1888 he removed the offices to Detroit street near W. 25th street. Colonel Pomeroy was born March 3, 1845, at Massillon, O., entered the service of the Union army in 1861 at less than 17 years old under his father Lieut. George Washington Pomeroy, and remained until the end of the war or until 1865, having been raised to the rank of quartermaster sergeant.

In the March 6, 1890, issue of *MARINE REVIEW*, Vol. 1 No. 1, ap-

pears a notice that Colonel Pomeroy had disposed of his interests in *Marine Record*. *MARINE REVIEW* as such had as its editors and proprietors John M. Mulrooney and F. M. Barton. Mulrooney had been marine editor of the *Cleveland Plain Dealer*, while Barton had been employed by the *Cleveland Press*. Colonel Pomeroy later engaged in various ventures in other cities, wrote a "History of the Great Lakes" for Beers & Co., of Chicago; became financial editor for a Sandusky, O., newspaper, and then entered the Soldiers' home at Sandusky as hospital treasurer, holding the position until three years before his death which occurred at St. Paul on July 25, 1926.

Gained Confidence of Leaders

The history of *MARINE REVIEW* under Editors Mulrooney and Barton over a long series of years forms one of the most interesting chapters of American journalism in the Middle West. It gained and retained for many busy years the confidence of the splendid men engaged in the Great Lakes industry, the doors of the offices of such leaders as Senator

M. A. Hanna, Col. J. M. Pickands, Capt. John Mitchell, Capt. James Davidson and many others always being open to John Mulrooney. The newsy columns of *MARINE REVIEW* even in those days and the steady growth in its advertising patronage both attest to these facts.

On Dec. 23, 1898, the Marine Review Publishing Co. was incorporated by John M. Mulrooney, John A. McGean, Waldon Fawcett, R. Schwartz and M. P. Mooney for the "purpose of printing and publishing *MARINE REVIEW*, the *Financial Review* and the *Blue Book of American Shipping*." The *Financial Review* was sold in the following February to John M. Chandler. In 1900 Ralph D. Williams became assistant to Mr. Mulrooney as editor of *MARINE REVIEW*, remaining editor for 15 active years.

On June 14, 1902, the Marine Review Publishing Co. bought *Marine Record* from C. S. McMahon and W. R. C. Smith.

On Feb. 2, 1904, the Marine Review Publishing Co. was purchased by the Penton Publishing Co. of which John A. Penton was president.

During the Pre-War Period--1900-1915

WHEN early in 1900 Ralph D. Williams became the editor of *MARINE REVIEW*, which position he was destined to hold for fifteen eventful years, he brought to the fulfillment of his duties a keen, well stored mind, an imperturbable temper, and withal, the balanced observing powers of a well trained newspaperman. He had need for the exercise of all his powers and initiative because he was to witness and record from week to week and month to month the constantly surprising evidences of the unfolding of the greatest industrial awakening that the United States ever had seen up to that period.

This awakening included within its complexity the tremendous increase in Great Lakes shipping attendant upon the amazing development in the Lake Superior iron ore mines, the vast expansion in the lake coal trade, the huge extension of our coastwise shipping, the sharp stimulus to the laggard unfolding of our inland waterways, the extraordinary burst of speed in American shipbuilding due to rapidly increasing volume of domestic and foreign trade to be moved, and finally the exporting spur that sent the American flag into practically every port of the seven

Ralph D. Williams

Editor, Marine Review, 1900-1915

By J. F. Froggett

seas, throughout all the world.

Following the ending of the Spanish-American war in the autumn of 1898, wherein the inadequacy of our small but well disciplined navy, not to mention our then decadent merchant marine, was exposed mercilessly, the congress had voted to put a real navy into the water. Williams saw the inception of that new navy movement and observed from 1901 forward and carefully chronicled every step in the carrying out of the nation's vast naval program. This program involved the then unprecedented expenditure of over \$81,000,000 of the nation's money.

About this time came the broad development of ocean harbors at San Francisco, New Orleans, Seattle, and others; the huge government work in deepening the river channels between the Great Lakes, and improvement of lake harbors with the wonderful Hulett unloader, successor to the Irishman's shovel and wheelbarrow; and one after the other, the splendid American shipyards along lake and ocean. Too, there had started the

national encouragement in the furnishing of vast sums of money to the development of our important but shallow and shifting inland rivers such as the Ohio and Mississippi, the destined avenues of a vast potential industrial trade. These all found full description with splendid illustrations in the columns of *MARINE REVIEW*.

But from the start of this editor's administration, *MARINE REVIEW* took a broad, worldwide view of maritime affairs. The great shipyards in Great Britain, Germany and elsewhere were described fully with illustrations. Back as far as 1900 it employed and encouraged special correspondence from Glasgow, Hamburg, Antwerp and other important ports of the world telling of marine conditions. The newest ideas in warship and merchant vessel construction, the latest feats in navigating practice, accomplishments in engineering and economical management—all these and many additionally absorbing, interesting details were set forth clearly in the columns of this publication all down through the quarter of a century since. Marconi was just beginning to develop his wireless telephony and telegraphy as it then was known, which since has done much to transform the art of navi-

1878-1928

Editors of Marine Review



Col. A. A. Pomeroy

Editor, Marine Record, 1883-1890

COL. A. A. POMEROY became editor and proprietor of the *Marine Record*, predecessor of *MARINE REVIEW*, on Sept. 6, 1883. He was born at Massillon, O., March 3, 1845, and joined the Union army at less than 17 years of age.

He died at St. Paul, Minn., on July 25, 1926. He was a deep student of Great Lakes affairs.



John M. Mulrooney

Editor, Marine Review, 1890-1900

JOHN M. MULROONEY and F. M. Barton brought out the *MARINE REVIEW*, March 6, 1890. Mr. Mulrooney had been marine editor of the *Cleveland Plain Dealer*. He was born in Cleveland, Nov. 8, 1864.



Ralph D. Williams

Editor, Marine Review, 1901-1915

RALPH D. WILLIAMS was editor of the *MARINE REVIEW* for fifteen years. He was born near Nottingham, England, in 1868, and when ten years old was brought to Cleveland, where he attended public school. He served on the *Cleveland Plain Dealer* until 1900 reaching the position of managing editor and Washington correspondent.



H. Cole Estep

Editor, Marine Review, 1916-1919

H COLE ESTEP, who was editor of *MARINE REVIEW* throughout the war period, attended public school at Seattle, Wash., and is a graduate of the University of Minnesota, with the degree of mechanical engineer. Since 1908 he has been associated with The Penton Publishing Co., Cleveland, of which he is now vice president.



A. H. Jansson

Editor, Marine Review

A H. JANSSEN, now editor of *MARINE REVIEW*, attended the public schools of Malden, Mass., and graduated in naval architecture and marine engineering at the Massachusetts Institute of Technology, in 1907.

He joined the staff of *MARINE REVIEW* in November, 1922.



R. V. Sawhill

Editor, Marine Review, 1920-1924

RAY V. SAWHILL, editor of *MARINE REVIEW* from 1920 to 1924, first received newspaper staff training at Mansfield, O. In 1910 he became associate editor of *Iron Trade Review*, and later assistant engineering editor, then associate editor and finally editor of *MARINE REVIEW*. He is now managing editor of *Domestic Engineering*.

gation. The six and even seven-masted schooner was being built and launched from Maine shipyards, marvels of handling by mechanical means due to Yankee ingenuity.

Editor Williams therefore may be pardoned for printing this paragraph in his review of the accomplishments of 1900 when he said in the issue of Jan. 3, 1901:

"To sum it up briefly in a line MARINE REVIEW published during the year 1900 a total of 2043 headed articles and 434 illustrations. Each of the 52 issues Marine Review was published every week in those days) contained an average of 26,000 words and 8 illustrations of a page or less in size. We do not think that there was anything moving in a maritime line that the REVIEW did not have."

The tremendous struggle in congress and outside over the Hanna-Payne subsidy bill in aid of an American merchant marine was taking place. Into the fray MARINE REVIEW threw itself without reserve in support of the bill. Lusty support was given the measure in its columns, but as now is well remembered, all to no purpose because the bill went down to defeat in the congress. And MARINE REVIEW did not fail to tell just how the defeat was due to the defection of certain Great Lakes district congressmen and named them.

Probably the most outstanding achievement of these early days was accomplished at this time. This was the establishment of a system whereby it collected the annual statistics of the Lake Superior iron ore mining industry, never before attempted. These figures were painstakingly compiled from the reports of hundreds of individual mining companies and mine captains scattered all through the then Lake Superior backwoods, and yet were so accurate and complete although quickly published in December each year that they have

retained their historical value back to the initial shipments in 1855 and every year since. Beside this, MARINE REVIEW started collecting and publishing at the opening of Great Lakes navigation each year the statistics of iron ore stored on lower lake docks as of May 1, the preceding year's shipments of ore from dock to furnace and such other statistics that since have proved invaluable to both the Great Lakes shippers and the consumers of ore and coal. This service, continued by this publication over a long series of years, finally was taken over and kept up ever since by the Lake Superior Iron Ore association of Cleveland.

With the launching of the vast United States Steel Corp. and its entrance into the Lake Superior iron ore trade and the Great Lakes vessel trade as an owner in 1901 MARINE REVIEW was quick to sense its vast importance and set it forth clearly and fully in its columns.

On Dec. 12, 1901, Editor Williams began publication in MARINE REVIEW as a serial his splendidly written and historically accurate "The Honorable Peter White." Thus around the narration of the active career of one man was written the most entertaining and complete account of the rise and development of the great Lake Superior ore trade, including the development of the shipping itself, docks, loading and unloading facilities unlike anything else in the world. This remarkable literary achievement since has been published in book form by The Penton Publishing Co.

In 1908 again MARINE REVIEW plunged into another exciting congressional contest in aid of the American merchant marine. It was on behalf of the ocean mail bill sponsored by Senator Gallinger.

Whereas MARINE REVIEW had been a weekly publication, in April, 1909,

or with No. 13 of volume 39, it became a monthly. The first issue as a monthly, contained 154 pages of reading matter and advertisements.

Whereas 1901 was a great shipbuilding year, so also were 1908 and 1909 both on the ocean shipyards and the Great Lakes. In the Feb. 7, 1901, initial "Shipbuilding Issue" of MARINE REVIEW are given the details of the projection of 61 warships by the federal government involving the expenditure of \$80,954,116 for hulls and machinery: while the Great Lakes yards held contracts to build 61 vessels of which 6 were wooden, at an estimated cost of \$12,535,000, with total carrying capacity of 3,000,000 tons annually. Again in 1908 there were 39 vessels building on the Great Lakes of which 24 were bulk freighters; and in 1909 there were 29 of which 11 were that type of ship.

In 1912 MARINE REVIEW published the then remarkable record made by the PETER B. WIDENER in unloading 10,636 tons of iron ore at Conneaut, O. in 2 hours and 50 minutes.

The disastrous Great Lakes storm of November, 1913, in which 19 great ships were wrecked and 235 men went to their deaths afforded this publication opportunity to display its resources and resourcefulness in gathering and printing the full details and illustrations of this unprecedented series of marine disasters.

The last stirring contest which MARINE REVIEW waged under direction of Editor Williams was in the spring of 1914 against the LaFollete seamen's bill in congress.

Shortly afterward, Williams became afflicted with illness, and despite everything possible to help him, his decline became so evident that his death in the following summer came as no surprise but to the deep regret of his many friends.

How Marine Review Met Emergency

BUSINESS publications such as MARINE REVIEW are essential to the proper functioning of modern production and commerce. In time of war they are even more necessary than in peace. During hostilities nearly every industry is placed under forced draft. Vast armies of men are withdrawn from production.

A steadying force in this unnatural situation is the business publication. It can be depended on for facts and leadership. It carries a heavy burden in time of war.

By H. Cole Estep
Editor, Marine Review, 1916-1919

In the struggle against Germany from 1914 to 1918, it early became evident that the allies could not win unless they kept the sea lanes open and their shipyards going full blast.

Shipbuilding soon became the very cornerstone of American war policy.

Its immeasurable importance to the winning of the war—to the whole vast complicated strategy of the allies—was early recognized by MARINE

REVIEW. In January, 1917, this publication said: "We are not yet awake. We have been only talking about upbuilding our merchant marine. While we have dwaddled and debated whether the government should spend \$50,000,000 for a dinky fleet of 50 ships, the hardy Norsemen have spent \$150,000,000 right here in our own market. Norway's merchant marine is a fact. Ours, comparatively speaking, is still a hope."

Five big jobs were undertaken by MARINE REVIEW during the war. Com-

plete facts on how to build wooden ships were presented in a series of eleven articles. No other publication attempted this task. Details of the remarkable feat of repairing the machinery of the interned German ships, which had been wrecked by their crews, were presented exclusively by MARINE REVIEW. This was made possible by a special arrangement with the navy department which supervised this stupendous job. This article was at one and the same time an inspiration and of great practical value. The great steel shipbuilding program of 1918-19 was fully covered by MARINE REVIEW. This series of editorial efforts culminated in a 32-page insert in which MARINE REVIEW was among the first to make public the true situation surrounding the Hog Island effort. One of the big difficulties during the latter part of 1918 was to procure sufficient machinery and equipment for the large number of hulls then under construction. MARINE REVIEW sensed this problem early in the year and attacked it vigorously. Finally in the first issue after the close of hostilities, the necessity for a sane and constructive postwar shipping policy was emphasized.

During the whole of the period this country was engaged in the war, MARINE REVIEW constantly kept in mind the special relationship which it always has enjoyed with lake shipping and shipbuilding. A specially heavy burden was laid on the lake marine fraternity during 1917 and 1918. Not only were the lake shipyards an exceedingly important factor in the steel shipbuilding program, owing to their immense capacity, but at the same time the cargo-carrying fleet on the lakes was called upon to move larger quantities of iron ore, coal, and grain than ever before. This fleet had to be maintained and augmented without interfering with the construction program which involved turning out hundreds of vessels of Welland canal size for salt-water service.

Ice Delayed Navigation

Lake navigation opened late in 1917. On account of the delays involved to wartime cargoes, MARINE REVIEW initiated a public discussion of the feasibility of opening channels in the early spring by means of ice breakers, thus artificially extending the season of navigation. Many prominent lake vessel men contributed to this discussion including Herbert K. Oakes, D. Sullivan & Co., William J. Wood, Robert C. Pringle, W. H. Reade, A. Leslie, Capt. B. T. Haagenon,

H. W. Thorp, and N. W. H. Smith. A special article was procured showing how ice breakers were used to keep open the entrance to Archangel in northern Russia.

Early in 1917 it was pointed out that shipments of 55,000,000 to 60,000,000 tons of iron ore would be necessary during the year. Strong committees promptly were organized to control this vast ore movement and the coal traffic. The organization of lake shipping for war purposes was headed by H. G. Dalton, Pickands, Mather & Co., Cleveland, chairman of the committee on iron ore, pig iron and lake transportation of the American Iron and Steel institute. With Mr. Dalton on this committee were Frank B. Richards, Harry Coulby, C. D. Dyer, W. T. Shepard, G. H. Woodward, Leonard Peckitt, Frank Billings and Amasa S. Mather. The subcommittee directing the ore movement consisted of Messrs. Dalton and Coulby, together with E. W. Oglebay, Frank Billings, and Mathew Andrews. The subcommittee in charge of coal traffic consisted of George D. Cameron, William Collings, H. P. McCue, E. A. Uhrig, and R. F. MacVeigh.

Meanwhile the work of mobilizing the lake shipyards for war purposes went forward under the direction of Henry Penton, Great Lakes district manager of the United States Emergency Fleet Corp. Realizing that the lake shipyards like those on the Atlantic coast could not commence to turn out tonnage in quantity until 1918, MARINE REVIEW pointed out the possibility in 1917 of sending certain ships then on the Great Lakes through the Welland canal to the coast. It was pointed out that the ships to be transferred should be selected carefully owing to the essential nature of the coal, ore, and grain traffic.

During the next year the shipyards on the Great Lakes made a real contribution to the great shipbuilding program of the allies. With all this activity MARINE REVIEW kept closely in touch culminating its efforts along this line with an article in the October, 1918, issue entitled "I am 29 Days Old—Look Me Over." This described the construction in record time of the 261-foot steel cargo carrier CRAWL KEYS at the Ecorse plant of the Great Lakes Engineering Works. This boat was launched 14 days after her keel was laid in an 80½ per cent completed condition. Fifteen days later she set sail for Europe. The American Shipbuilding Co. also made some remarkable records for speedy construction during this period. In order to save time, A. J. Patmore, yard superintendent of the American Shipbuilding Co., erected the plating of

the steamer LAKE NARKA before all the frames which had been delayed in transit were received at the yard. "We can do it," was his slogan.

Wooden Ships—A War Emergency

Meanwhile, vast activities were being organized in other parts of the country, and in the development of some of these MARINE REVIEW took a prominent part. When war was declared in April, 1917, it was evident that all of the steel shipbuilding resources of the country would be insufficient. MARINE REVIEW therefore joined with William Denman, first chairman of the shipping board, in advocating the construction of as large a fleet of wooden ships as possible as an auxiliary to the country's steel shipbuilding activities.

Now that the tremendous controversy which the wooden ships engendered can be viewed from the perspective of a decade, the soundness of the program as a war emergency measure is evident. In June, 1917, MARINE REVIEW said:

"All sensible men recognize the merits of the steel ship. Its superior effectiveness in many directions is readily acknowledged. But we are now face to face with a great national emergency in meeting which the wooden ship has a definite function to perform. The wooden vessel therefore finds that its usefulness for the time being is not measured by intrinsic merit. For the ranks of 'the little cargo boats, that sail the wet seas round,' are thinning fast as a result of the continual depredations of the slinking submarine."

It was clear enough to everyone, less than a year later, that any kind of a ship, even a floating bathtub, was worth its weight in gold. The wooden shipbuilding program therefore had a definite place in our wartime plans and on these grounds it was defended and its execution demanded by MARINE REVIEW. In addition, MARINE REVIEW proceeded to put into print a complete textbook entitled, "How Wooden Ships Are Built." This series of articles was at the time, and still is, the only practical treatise in existence on this subject. These articles ran continuously in MARINE REVIEW for a year, commencing with the issue of June, 1917. Detailed plans and specifications, and numerous photographs showing every step in wooden shipbuilding were published.

The controversy over the wooden-ship program, which was never intended by responsible authorities as a substitute for steel shipbuilding effort, came to a climax in June, 1917 in the famous quarrel between Maj. Gen. George W. Goethals and William Denman, chairman of the shipping board. Gen. Goethals made a speech

at the annual dinner of the American Iron and Steel institute condemning the over-enthusiastic claims of some of the superheated patriots in the ranks of the wooden ship advocates. "When I looked into the plans and specifications, I found none," said Gen. Goethals. "When we consider that the birds now are nesting in the trees that are to go into these ships, it is evident the proposal is simply hopeless." This quotation is of interest now chiefly as reflecting the tremendous confusion which prevailed at the time. Gen. Goethals' statements were disputed by F. A. Eustis, assistant general manager of the Fleet corporation, and F. Huntington Clark, his assistant. The next morning these gentlemen resigned. But within a month Gen. Goethals himself was out and President Wilson also brought about the removal of Chairman Denman in order to restore morale.

A Real Job Well Done

But while all these efforts toward organizing a real shipbuilding program, both wooden and steel, were being put forth, the war was going on. Ships were being sunk by the dozens every week. It was essential therefore to get every possible vessel already built and not in service into commission. It was for this reason that ships were cut in two on the Great Lakes and brought out to the coast as previously described. For the same reason the navy took charge of commissioning the fleet of interned

German merchant ships which were seized in our harbors when the United States declared war.

There were 109 of these vessels, a number of them of large size including the LEVIATHAN, then known as the VATERLAND, GEORGE WASHINGTON, KAISER WILHELM II, and others.

When we came to commission these ships, it was soon discovered that their machinery had been systematically wrecked by their German crews.

The Germans thought they had put these ships out of commission for the duration of war, but American ingenuity was equal to the situation. Applying the principles of welding developed in railroad shops, repairs were effected and within a few months all of the interned German liners were in service under the American flag. As previously mentioned, to MARINE REVIEW was given the exclusive privilege of describing how this great reconstruction job was done. This article, published at a time when not only the shipbuilding but the military efforts of the allies were at a low ebb, was a real source of inspiration.

As the war wore on the need for even greater effort in the shipbuilding program became evident. Men were scarce and MARINE REVIEW turned its attention to articles on methods of training shipyard workers and to the labor problem. An important contribution on this subject entitled "Ship Labor Under the Microscope" appeared in the March, 1918 issue.

But in spite of difficulties, political maneuverings, and wartime confusion and hysteria, the American shipbuilding program marched steadily forward. Big men were everywhere putting their shoulders to the wheel—such men as Homer Ferguson, Admiral Bowles, Charles M. Schwab, and many others. Yard after yard swung into action. A map printed in the March, 1918 issue of MARINE REVIEW shows the location of 93 active shipbuilding plants within the borders of the country. The shipping board organization had become so large by August, 1918 that four pages of MARINE REVIEW were required to chart its principal functions. The great Hog Island yard reached the apex of its activity. Far-seeing men began to look forward beyond the close of hostilities.

Forward to Victory

The outlines of the post-war problem were sketched clearly by MARINE REVIEW in December, 1918, immediately after the signing of the armistice. "The war," it was stated, "has revealed the falseness of many former theories. The reborn American merchant marine must be kept alive and to that end the throttling legislation of pre-war days must give way to laws which will foster rather than retard." We still await their enactment although some progress has been made and the American merchant marine today is some three times larger than it was when the Kaiser marched on Belgium.

Reconstruction Period After the War

THERE are two dramatic periods of action in American Maritime history. The first, of course, stretches over much of this country's earlier existence but comes to a climax with the clipper ship days and the record which these fast fliers piled up in the transatlantic, Cape Horn and China trades. The other will center about the tremendous effort made during the World war to overcome in a few months' time the harmful effects of years of indifference to our marine welfare.

Probably a picture of the "GLORY OF THE SEA" with her white wings spread to the trade winds, will always win the admiring attention of all Americans, no matter how ignorant one may be of seafaring affairs, and will serve as an inspiration to the youngster who looks forward to rounding the Horn under sail. It is difficult to visualize the same rapt attention to a photograph of the colossal

By R. V. Sawhill

Editor, *Marine Review*, 1920-1924

spread of ways at Hog Island. Yet each picture will be in its way a beacon light in our history. If it accomplishes no other purpose, this wartime marine activity has forced the merchant marine problem into the attention of the American public. While the results have been far from encouraging, it seems at least hopeful that indifference has been forced to give way to attention, even though the ultimate solution is still far in the future.

MARINE REVIEW, during a lifetime of 50 years, has witnessed the most important change in ocean transportation that has taken place since recorded history began. The life of MARINE REVIEW is practically synonymous with the development of the metal ship and the abandonment to a great degree of the wooden sailer,

which for centuries had represented the peak of marine engineering design.

During a few of those crowded years, the author had the privilege of directing the editorial activities of MARINE REVIEW. The interval took in some of the war days and much of post-war period.

A congress which had resisted every appeal from leaders of the marine industry for years, turned right about face and appropriated funds even faster than the industry could possibly absorb. While the full effect of this expansion was never felt as far as war service was concerned, an impartial survey of the accomplishments during 1917 and 1918 will record that no industry met its wartime obligations more fully than did the shipbuilding and shipping trades. A business paper in such a period had unusual obligations thrust upon it. Whether it liked the wooden ship

building program or not, the obligation to try and make it successful after the country had once embarked on it, was distinctly there.

So those days saw the development by the MARINE REVIEW organization and especially by H. Cole Estep, the author's predecessor as editor, of the first modern treatise on wooden ship construction, and which proved invaluable in the hands of organizations struggling with the troublesome questions of design and construction, where both textbooks and experience were lacking. Similarly problems of expanding organization, of handling fabricated ship construction problems, of yard management, and the hundred and one questions which thronged in upon the time and attention of men new to this business, occupied our pages.

And immediately after the war, developed the almost equally pressing question of how organizations were going to be developed to take over the management and operation of these ships. In that work, MARINE REVIEW was among the first to feel the call and a study of its columns during the immediate postwar period will find a wealth of information designed to instruct both the executives and members of shipping organizations in the technique of ship management and operation. These questions took in both shore and sea problems, that is, from a study of how shore routine had to be carried through and business secured and profitably handled, along to the questions which occupied the minds of the engineers on board ship regarding economy of operation, fuels, etc. Probably such a recital has not the interest which is held by an analysis, years later, of what it all meant.

America again turned its attention to land problems and with prosperous days prevailing over much of the period since the war, the time and money of America's bankers and business leaders, again centered upon domestic industries. Hampered by

governmental interference and regulation, political intrigue, the war born shipping industry has naturally found almost insurmountable obstacles to its progress.

Today, however, it seems evident that this same industrial expansion has brought about a supply of domestic made products which is so abundantly able to meet the demand, that we find industrial leaders everywhere talking of profitless prosperity and giving their attention more than ever before to questions of distribution. As this question looms larger and larger, the export market is beginning to take its position as a regular division of American industry rather than a spasmodic outlet whenever domestic demands lag. The automobile industry has been a leader in the development of this foreign field. It seems inevitable that this obligation to keep plants operating as near capacity as possible, will give to this export business an importance it never before enjoyed. As this condition crystallizes, the importance of having assured and friendly transportation always available for these American made products, will bring to the American shipping industry, a sympathetic attention by the American business and financial leaders which it has not enjoyed for years.

A little story will illustrate the degree of indifference or willful distortion against which American shipping has always struggled. At a gathering in Washington, one of many, in which the problems of private and government ownership were gone over during the postwar period, E. N. Hurley, then chairman of the shipping board, presided at this particular meeting. An audience of leaders in the shipping field attended, and the meeting ran along with a serious and intelligent discussion of private ownership and the best means of securing it.

In carrying out his advance program, Chairman Hurley near the end of the meeting asked for any advocate

of government ownership to express himself and a ripple of laughter went over the audience at the absurdity of such advocacy. Much to everyone's surprise, a man arose and announced that speaking for the farmers of America, he demanded government ownership. Mr. Hurley interrupted to find out who he was and what he represented, and after being stopped at the beginning of several imminent speeches, the man finally gave the name of an organization which from its title, was supposed to represent the farmers. In working up to the climax of his appeal for government ownership, the man used as his all-embracing argument the fact that under government ownership the cost of carrying a letter from Philadelphia to New York had been reduced from 25 cents to 2 cents, a record which no private industry could equal. The unfairness of contrasting the beginning of a stage coach mail service of the days immediately after the American revolution, with railway postal service nearly 150 years later, was not permitted by this man to sway his arguments.

In a broad way, the record of American shipping since the war is a satisfactory one. We have private lines now in service, developed by trained organizations to at least a greater degree than in the lean years before the war. Some of the lines are proving their right to existence against the strongest sort of foreign competition. Americans have been taught the advantages of ocean travel and American industry has learned the importance of export trades as a balance wheel. With some of the newer and stronger American industries taking an intelligent and continued interest in this trade, we can certainly count the expansion of the war and its immediately following years, as holding out for American marine industry something more tangible and satisfactory than a record of political interference, idle ships and lost opportunity in placing us on the seas.

Era of New Spirit in Marine Affairs

By A. H. Jansson
Editor, Marine Review

THE war left the United States strengthened in her industries and with a large merchant fleet. Trade increased and in 1920 American vessels carried 42.7 per cent of overseas commerce in and out of United States ports as compared with 8.7 per cent in 1910. Naturally a feeling of optimism for the future of the merchant marine prevailed. Never since the decline of our mari-

time supremacy had so good an opportunity offered for regaining our position in the ocean carrying trade.

Foreign offers for government owned tonnage at high prices were scorned and even to American citizens such tonnage was sold only at a figure three and four times the

prewar cost. Cargoes were plentiful and rates were correspondently exorbitant. No wonder even practical steamship men were carried away with enthusiasm. Prospects never were brighter.

After Europe had had a breathing spell of two years came a terrific reaction. Conservatism, order, caution again began to control action; trade slumped and ships became a

drug on the market. The years from 1921 to 1924 were most trying for the government fleet and for private operators, especially those who had made pioneer purchases of tonnage at fancy prices. American shipping, we believe touched the very bottom of depression in this period.

Build Modern Fast Ships

At the same time the grim facing of reality and stiffening of purpose on the part of the other belligerent and neutrals served as a solid foundation for their merchant marine rejuvenation. Having lost much obsolete tonnage during the war they started building modern economical ships of higher speed, particularly suited to specific trades. Content with small profits and with limited opportunities ashore they worked like beavers to give the best possible service at low rates. Business fell away from American ships like leaves from the trees in autumn. The reversal was frightful.

This was the condition of affairs when MARINE REVIEW began the year 1925. Hundreds of idle government ships and many privately owned were laid up. The time of reckoning had come but unfortunately there was no Solomon either on the shipping board or in the cabinet or in the White House to decide what to do. It is in no spirit of captious criticism that it was pointed out in MARINE REVIEW that the shipping board was muddling along without a coherent clear cut policy. Those members of the board including the chairman who inclined toward a businesslike administration were often balked by others of the Simon-pure bureaucratic type. Even the President himself was rebuffed in a manner for which it is hard to find a parallel in history.

But we have said that this period is the era of new spirit in marine affairs and beginning early in 1925 and continuing up to the present time MARINE REVIEW has faithfully related the many moves toward a better understanding and a healthier fundamental condition.

It was at the beginning of this period that Chairman O'Connor started his campaign for scrapping large blocks of utterly useless obsolete idle ships and before the end of 1925 it is noted that Henry Ford's offer of \$1,706,000 for 199 of the smaller vessels had been accepted. The sequel was told in a complete article on the methods he used in scrapping these ships.

A determined effort was carried out to modernize 12 of the larger government freighters by conversion to diesel drive in order to promote the lagging

diesel industry so that American manufacturers would be in a position to furnish this efficient type of power for our private owners. This program has been completed. The trial trip of the last vessel, the WILSCOX, was recorded in a recent issue of MARINE REVIEW.

A considerable number of shipping board ships and services have been sold to private operators. One of the last sales eliminated government operation entirely from the Pacific.

To emphasize the need for efficiency in the handling of cargo, many articles on various systems and methods in use here and abroad have been published. All important development in ship operating economies have been noted. The advantages of applying modern engineering principals in the design, building and operation of ships have been dwelt on time and again.

Diesel drive, use of high pressure steam, possibilities of pulverized coal and the application of electric drive all point to better economy. A complete review of American merchant shipbuilding in detail and illustrated has been published each year. We know of no source where such complete and authoritative information is given for so many types of vessels all recently built. The operator, the designer, and the shipbuilder in this review of distinctive American vessels have a source which serves as a guide to progress and improvement.

Better Prospects in Sight

An uninterrupted record of entrances and clearances at 18 principal ports for the current and ten months back is an invaluable guide, conveniently arranged, of the status of our overseas business. Maritime law cases and marine disasters have been recorded. Activities in connection with the building and operation of vessels on oceans, lakes and inland waters have been told promptly and with accuracy.

As we come to the middle of 1928 and the enactment of the Jones-White bill which, taken in conjunction with the law of 1920, is the most constructive marine legislation in over two generations, the American merchant marine, without illusions of grandeur and hardened by adversity, faces the era of a new spirit in marine affairs with confidence.

To work for the building up of an American mercantile fleet adequate for the needs of our growing commerce and as an efficient auxiliary in national defense, a merchant marine composed of modern vessels properly equipped, well manned and efficiently operated, has ever been, since its

foundation fifty years ago, the purpose of MARINE REVIEW.

Gerhauser Elected Head of American S. B. Co.

At a meeting of the board of directors of the American Ship Building Co. at Cleveland on June 27, W. H. Gerhauser, for a number of years vice president, was elected president to succeed the late Alfred G. Smith. Mr. Gerhauser has been in fact managing the company during the many weeks of Mr. Smith's illness. Throughout his connection with the American Ship Building Co. he has shown marked ability and attention to duty. It therefore does not come as a surprise that he has been made president. Only 39 years of age, he faces the responsibilities of his important office with years of experience as well as youth and vigor.

The total assets of the American Ship Building Co., according to the last annual report, is \$25,186,543. Besides the parent company there are six subsidiary shipbuilding and ship repair companies at strategic locations on the Great Lakes from Buffalo to Superior. Mr. Gerhauser is a son-in-law of M. E. Farr of Detroit, formerly president of the American Ship Building Co., resigning in 1923. Other officers elected at the meeting were: G. W. Cottrell, general counsel, made vice president; R. B. Ackerman, auditor, who was made acting secretary. The regular 1% per cent dividend on preferred stock and also 2 per cent dividend on common were declared.

New Board Commissioners

Rear Admiral Hutch I. Cone, retired and Samuel S. Sandberg, newly appointed commissioners of the shipping board took the oath as members of the board on June 9. Admiral Cone succeeds Rear Admiral William S. Benson, retired, who has been a member of the board for the past eight years. Mr. Sandberg, formerly chief executive of the Los Angeles Harbor commission succeeds Phillip S. Teller whose term expired.

Both of the two new members are known to be strongly in favor of private ownership and operation. In this respect they will be in complete agreement with Chairman T. V. O'Connor who has striven to place government services and ships in the hands of private owners and operating as rapidly as it was possible to do so and at the same time to keep the services going under responsible management.

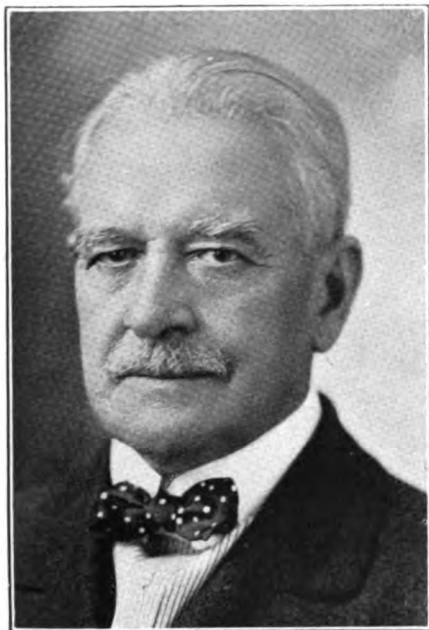
Great Lakes Lose Two Notable Men

Harvey D. Goulder, 1853-1928 - - Alfred G. Smith, 1875-1928

TWO notable personages were removed from Great Lakes shipping circles in the passing, within a few days of each other, of Harvey D. Goulder on June 14, and Alfred G. Smith, June 5; both men of national prominence whose names were linked to major maritime activities for many years.

Harvey D. Goulder

HARVEY D. GOULDER won international fame as an admiralty lawyer and was highly respected and beloved by a host of friends and business acquaintances. Mr. Goulder was born in Cleveland, March 7, 1853,



HARVEY D. GOULDER

a son of Christopher and Barbara Goulder. He received his education in the public schools of Cleveland, studied law and was admitted to the bar in 1875. He always took a keen interest in civic affairs and served a term as president of the Cleveland chamber of commerce. Mr. Goulder was one of the organizers of the Lake Carriers association and he served as general counsel for the organization from its inception a quarter of a century ago until he resigned in 1926. He was known from one end of the Great Lakes to the other as an oracle of maritime law and his opinions were eagerly sought and highly respected.

During more than a half century, Mr. Goulder saw the commerce of the Great Lakes grow steadily from small beginnings to its present-day prominence. Throughout his long and illustrious business career he successfully endeavored to improve inland waterways and through his efforts government aid was obtained to expedite navigation and to insure the safety of passengers. The best that can be said of Harvey D. Goulder is that he labored mightily to better maritime conditions and his accomplishments are a living testimony of his stupendous efforts. He was faithful and zealous and he justly earned the high reputation he enjoyed.

The funeral services were conducted by Dr. Charles F. Thwing at the Fairmount Presbyterian church, Cleveland on June 16. Burial was at Lakeview cemetery.

Alfred G. Smith

ALFRED G. SMITH came from a family of shipbuilders. He followed the vocation of his father, entering the industry at an early age and devoted his entire life to it. That he knew shipbuilding as few other men do in all its intricate details of design and construction is generally conceded, and the fact that he was made president of the American Ship Building Co., in 1925, speaks for his high standing among his business associates.

Mr. Smith served an apprenticeship at the old Globe Iron Works, now the American Ship Building Co. His father was connected with that organization until his death in 1903, at which time he occupied the position of superintendent. Identification with various shipbuilding plants on the Great Lakes gave Mr. Smith an unusually wide and comprehensive knowledge of shipbuilding methods. When the merger was made which resulted in the formation of the American Ship Building Co., in 1899. Mr. Smith was foreman of construction at the plant of the Cleveland Shipbuilding Co., Lorain, O. He then joined the American organization and later he was superintendent of the Buffalo Dry Dock Co., one of the plants under the merger. As his career developed, he went to South Chicago, Ill., to assume

the general superintendency of the Chicago Shipbuilding Co., another American unit. Here he supervised the construction of the W. E. COREY and the E. H. GARY, two of the original four boats of the Pittsburgh Steamship fleet, and at that time the largest bulk freighters on the Great Lakes.

In 1914, Mr. Smith became general manager of the American Ship Building Co., with headquarters in Cleveland. Later he was elected vice president, which office he held throughout the World war, having charge of plant operations. As such he was chief directing officer for carrying out the larger government shipbuilding pro-



ALFRED G. SMITH

gram on the Great Lakes. The fact that the work was completed successfully and that the vessels constructed were up to standard in every respect speaks highly for his great ability and intensely active devotion to duty during the hectic days when we were building "a bridge of ships to France."

Mr. Smith was elected president of the American Ship Building Co. in 1925; a well deserved recognition of his all around fitness for the position.

The funeral services were conducted by Rev. E. E. Wilson at the People's Methodist Episcopal church, Cleveland, and burial was at Riverside cemetery.

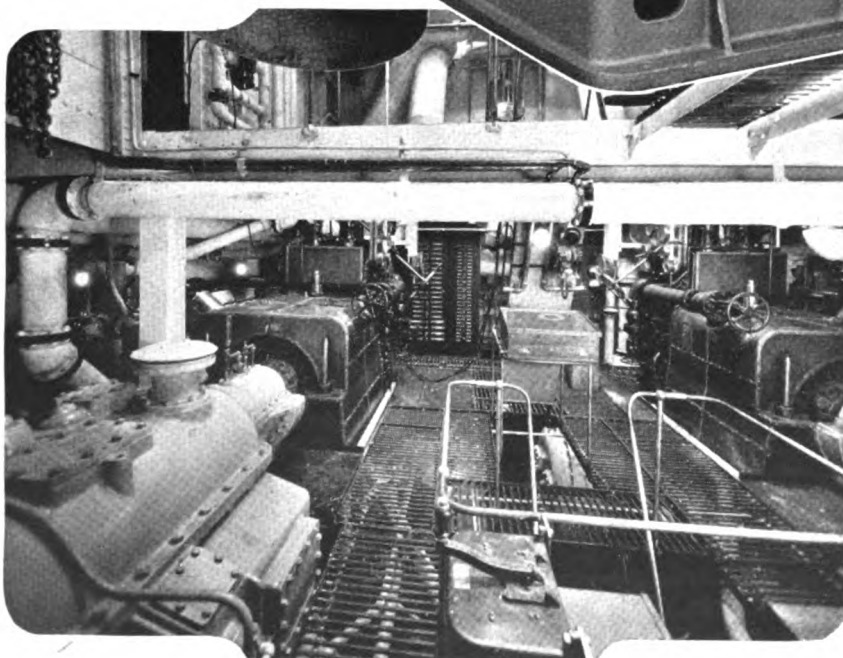
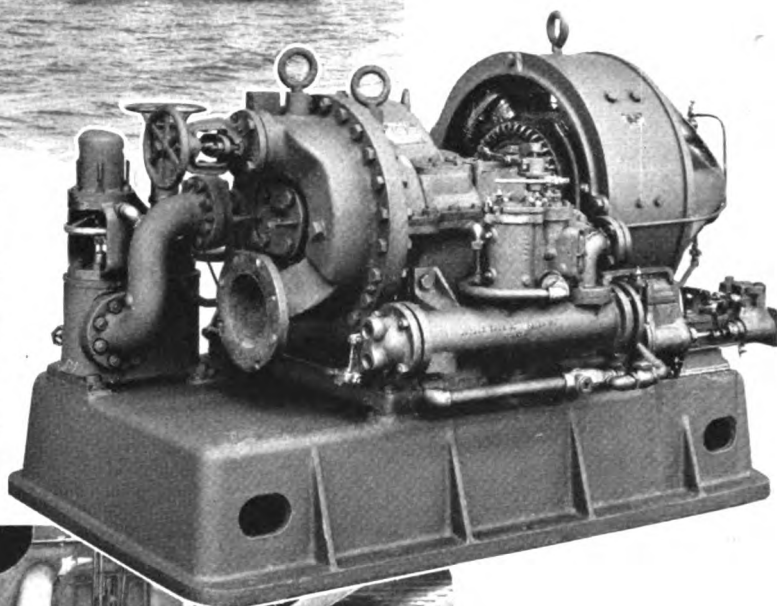
1878-1928

Waialeale Is Turbine Driven



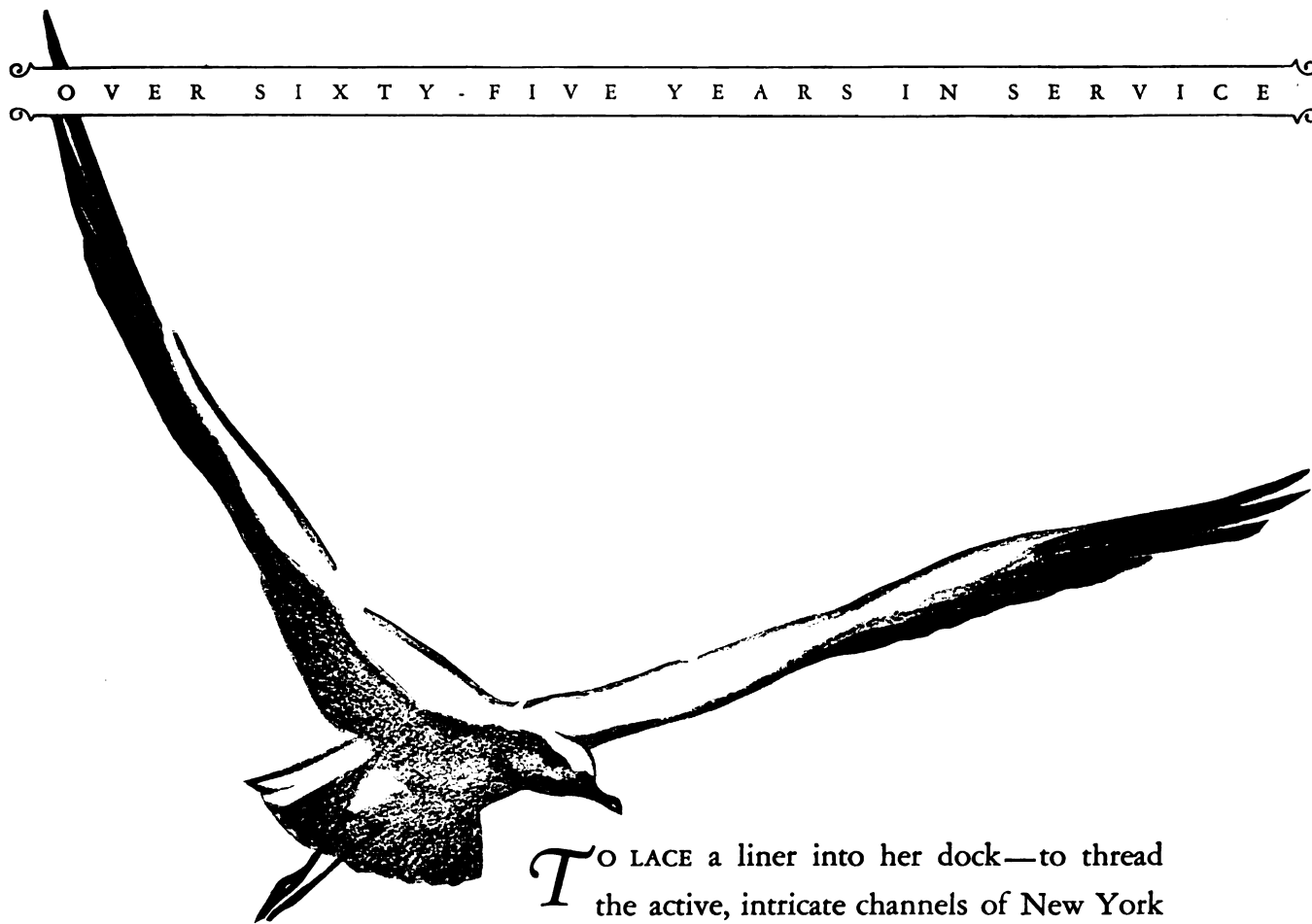
Upper—Magnificent Pacific liner Waialeale of the Inter Island Navigation Co., recently placed in commission between the islands of the Hawaiian Group—This vessel is 310 feet 10 inches overall with a deadweight capacity of 1800 tons—Built by Bethlehem S.B. Corp. at the Union plant, San Francisco. She has two 2000 h.p. Westinghouse geared turbines.

Below—Closeup illustration of one of the 94-kilo-watt auxiliary turbine generators—the engine and the generator are direct connected.



Left—Engine room of the Waialeale—These turbines are of the complete expansion impulse reaction type with the cylinders bored conically for effective steam expansion—The turbine exhaust flange of each engine is bolted solidly to the condenser inlet flange and the condenser serves as a support for the turbine at the exhaust end—Each turbine is fitted with two ahead nozzles, either or both of which may be opened as required by the operating conditions.

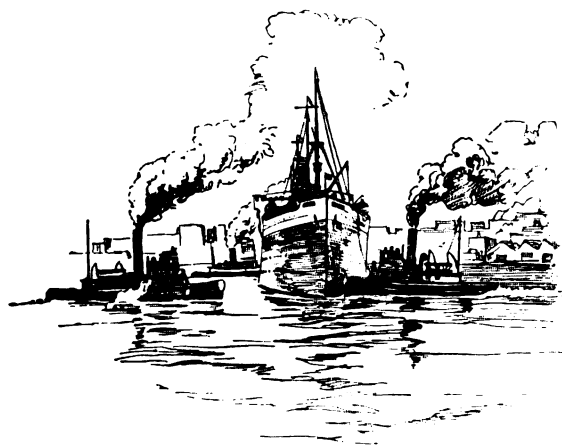
O V E R S I X T Y - F I V E Y E A R S I N S E R V I C E



TO LACE a liner into her dock—to thread the active, intricate channels of New York Harbor—in other words to handle safely, reliably, yet economically, transatlantic and coastal shipping within this port requires a vast experience, a comprehensive knowledge, and a wealth of quality equipment.

—plus a competent organization and a solid financial background.

All of which has been included in Moran Service for three generations to important owners, operators and industrial groups.



MORAN TOWING AND TRANSPORTATION COMPANY, INC.
17 Battery Place, New York, N. Y.

MORAN
Service



Marine Events Reviewed

(Continued from Page 39)

his way past whirling arms of steel that would have cut him to bits had they struck him, to throw a lever in reverse and thus bring a wildcat engine to a standstill and save his ship. There is the third engineer of *CARMANIA* who entered the drum of a turbine with the temperature at more than 178 degrees, only to be thrice overcome before accomplishing his self-imposed but necessary task of closing traps. Such are the deeds with which these volumes abound.

From the early days of such boats as the *NEW YORK*, *PARIS*, *ST. PAUL* and *ST. LOUIS*, there was an almost steady procession of new and larger and more luxurious boats and, in the main, faster boats. There were the *LUCANIA*, *KAISER WILHELM DER GROSSE*, *DEUTSCHLAND*, *CELTIC*, *BALTIC*, *LUSITANIA*, *MAURETANIA*, *OLYMPIC*, *IMPERATOR*, *VATERLAND* and others.

The sinking of the *OLYMPIC*'s sister-ship, the *TITANIC*, on her maiden voyage to New York stills stands as one of the greatest disasters of all time. Newspapers for days were filled with the details of this tragic happening. Yet, so staggering and profound was the effect upon the compiler of these volumes that direct mention of this disaster is to be found in but one little paragraph. This was in the words of J. Bruce Ismay, president of the International Mercantile Marine Co., in his annual address to company stockholders three months later:

"Your directors with great regret record the loss of the steamship *TITANIC* on April 15, 1912, on her maiden voyage from Southampton to New York. The steamer collided with an iceberg and foundered shortly thereafter, and a most serious and deplorable loss of life resulted, for which your directors record their profound sorrow; and also their deepest sympathy with the relatives and friends of the passengers, officers and crew to whom this disaster has brought great bereavement."

Various clippings relate to new achievements in marine engineering. In 1902, much was written concerning the conversion of liners to burn fuel oil instead of coal. In 1905 is recorded the successful maiden trip of the *VICTORIAN*, the first new turbine passenger steamship to cross the Atlantic. "The turbines exceeded all expectations," said Captain McNichol. "Full speed was impossible because of tempestuous weather and the priming incidental to new boilers. Yet the *VICTORIAN* maintained a speed

approximating 15 knots."

In 1908, a dispatch from Charlottenburg, Germany, told of a compass with a magnetic needle, which had just been invented. "It is," the account read, "in the form of a gyroscope, which, when suspended in a certain way, always adjusts itself to the earth's axis. The invention is regarded as of great importance to ironsides, where the compass needle frequently is deflected by adjacent metal."

The First Diesel Vessel

Another development much discussed a few years later was the motorship. A dispatch from Copenhagen, Feb. 14, 1912, described the official trial run of the diesel propelled ship, *SELANDIA*, a twin screw vessel of 7400 tons deadweight. She was reported to have done 13 knots through ice, a demonstration highly praised by shipping representatives from many countries who were on board.

Satisfactory conditions in ocean trading appeared in 1910 after a long lean spell. The White Star line reported net profits of 30 per cent for that year and the *New York Times* on Jan. 9, 1912, said the following:

"Ocean freight rates have advanced by leaps and bounds within the past few months and since the new year have reached the point which has not been experienced by shipping men for 10 years. Meanwhile, available cargo space is limited and premiums are being paid by some belated shippers for quick accommodation. The advances run through the whole range of commodities and affect all of the Atlantic ports and Gulf ports as well.

"It is only two years ago," this paper continues, "since the shippers of the world had the transportation lines and the owners of tramp steamers practically at their mercy. Several of the big Atlantic lines had reduced their dividends and tramp steamers were laid up by hundreds in the Firths of Scotland. Now the docks are clear of them."

One of the several reasons given for this boom lay in a 16,000,000-bale cotton crop, which, besides breaking all records, came at a time when foreign spinners were out of stock.

Around this time the question of free passage for American ships through the Panama canal was beginning to engage the attention of shipping interests. This question continued a matter of much controversy for many months or up to and even following the official opening of the canal Aug. 15, 1914, when

the steamship *ANCON*, owned by the war department and operated by the Panama Railroad Steamship Co. for service between New York and Colon, was the first to pass through.

The passing years took their toll among many long prominent in the marine world. In December, 1912, C. A. Griscom, chairman the International Mercantile Marine Co. and Gustav H. Schwab, former head of Oelrich & Co., general agents for the North German Lloyd steamship lines, died within three days of each other. Then four months later came news from Rome of the death of J. Pierpont Morgan, and six months after that the mysterious disappearance of Dr. Rudolf Diesel, famous inventor, from aboard the *DRESDEN*, bound from Antwerp to London.

The advent of the World War brought with it many memorable days, with an accompanying acceleration of events. Aug. 1, 1914, saw the withdrawal of German steamships from service and the cancellation of bookings of 8000 who had engaged passage at New York alone. The *LUSITANIA* sailed from New York to be picked up outside Sandy Hook by the British cruiser *ESSEX* which had just convoyed the *OLYMPIC* past three German cruisers off the eastern coast.

The *KRONPRINZESSIN CECILIE*, carrying \$13,000,000 in species and 1215 passengers, found haven at Bar Harbor, Me.; she was turned back by wireless when within two days steaming of the first port of call, Plymouth, England. The French liner *LORRAINE*, sailed, while 8000 persons on the pier and 2000 reservists at the rail sang the "MARSEILLAISE." Halifax, Nova Scotia, reported on Aug. 6, the unexpected arrival of the *MAURETANIA* and *CEDRIC*, due to presence of hostile vessels in North Atlantic waters. The *MAURETANIA* was taken over by the British admiralty for fitting out as an auxiliary cruiser.

The *ST. PAUL* sailed with 1000 for Liverpool, the first American ship to arrive there with passengers and mails in 50 years. The *OCEANIC*, with \$15,000,000 aboard, raced safely across the Atlantic to Southampton with all lights out. Germans aboard wanted the ship captured; English prayed for more steam.

Many German ships were offered for sale. The *KAISER WILHELM DER GROSSE*, converted liner, went down off the African west coast, victim of the British cruiser *HYFLIER*. The *OCEANIC*, favorite of Morgan, Vanderbilt, Whitney and many others, was wrecked on the Northwest coast of Scotland.

In the midst of these hectic, feverish days, the log ends.



M. S. "Steel Motor". Operated by the Isthmian Steamship Lines. Equipped with 750 SHP McIntosh & Seymour 4 Cycle, 6 cylinder Diesel Engine.

Her Diesel Engine is Lubricated with **TEXACO Algol Oil**

The M. S. "Steel Motor" was built in 1923. Since that time, no other oil but **TEXACO ALGOL OIL** was used for the lubrication of her 750 SHP McIntosh & Seymour 4 Cycle, 6 cylinder Diesel engine.

TEXACO ALGOL OIL, one of the famous "URSA" series, is a clean, clear Diesel engine lubricant—pure golden in color.

TEXACO ALGOL OIL has the proper viscosity for work. This will be demonstrated by the way it clings to the cylinder walls and pistons.

By the way it maintains compression and enables easy starting and delivery of **FULL POWER**.

The Diesel Engines of many motor ships on the seas today are **TEXACO** lubricated—and for good reasons:

1. The Texas Company's marine lubricants are *dependable*.
2. There is a **TEXACO** lubricant for every purpose aboard ship.
3. The Texas Company's Marine Engineers are at your service to help you secure ideal lubrication—anywhere—anytime.

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MARINE REVIEW—July, 1928

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Shipbuilding Progress

(Continued from Page 45)

They are capable of attaining a speed of 22 miles an hour. The engines of these vessels are inclined 3-cylinder compound, with cylinders 66 x 96 x 96 inches, with a 108-inch stroke, developing 12,000 horsepower. When the tentative designs for the vessels were laid down serious consideration was given to screw propulsion and turbine engines. However, from long experience and intimate knowledge of the conditions of service to be encountered it was decided that side wheels driven by an inclined compound engine would best serve all requirements. These craft therefore are a genuine American type specially adapted for the trade in which they are engaged.

The oscillating engine had no cross-head. The cylinder oscillated in trunnions and the piston was connected directly to the paddle wheel or propeller shaft. In the case of propeller boats the slow speed engine was connected to the propeller shaft through the medium of spur gearing which was quite noisy in operation. Steam was admitted through the trunnions to slide valves on the cylinder sides.

Many Types of Engines Used

The side lever engine was another monstrosity. The one cylinder was vertical with the piston rod projecting through the upper head. From a crosshead on the piston rod a pair of links, one on each side of the cylinder, led down to the ends of a pair of horizontal beams or levers below. These oscillated over fixed gudgeons at or near their centers. The two levers were joined at their other ends by a cross tail from which a connecting rod led to the crank above. These units were also called grass-hopper engines.

Another fearful contraption was the trunk engine. It was designed primarily to do away with the spur gearing then used on propeller steamers. Lack of space on each side of the shaft formed an obstacle to the use of horizontal engines of conventional design—hence the trunk engine. In this engine the piston rod was hollow and extended through both cylinder heads. The connecting rod was located in the center and the hollow piston rod or trunk, made large enough to take care of the rod angularity.

The beam engine was and is a favorite with American builders and it is in use at the present day. It consists of a gallows or A-frame, terminating in the walking beam which rocks in gudgeons. At one end, usually forward, is the cylinder, the piston

of which is connected to the cross-head which runs in guides. A link connects the crosshead with the beam.

The steeple engine is a British contrivance with the cylinder set vertically below the crank. Two piston rods projected through the cylinder head, one on each side of the shaft and of the crank. They were united by a crosshead working in vertical guides and from this a return connecting rod led to the crank.

The horizontal engine is an American invention and is found to this day on Western river steamers. The usual installation consists of two engines one on either side of the lower deck. In side wheel steamers, each engine is cranked independently which design permits quick maneuvering of the vessel; for by setting one engine back and letting the other run ahead the vessel could be turned almost as on a pivot. Engines of both types are fitted with poppet valves generally, while the steam cutoff is controlled by cams on the main shaft.

That the turbine has come to stay cannot be questioned. It offers high speed with an absence of reciprocating parts. The speed of the turbine is now generally reduced to proper propeller speed by gearing and in late vessels by use of electric units. It cannot be reversed directly, however, so separate reversing units must be provided. The electric drive permits direct reversal while the turbine turns in one direction. Superheated steam is a decided improvement as its use overcomes condensation losses thus increasing the efficiency. The diesel engine is rapidly winning a place of recognition. Since this engine burns its fuel directly in the cylinders the thermal efficiency is high. Diesel engines are of two general types, two and four cycle, and each type may be single or double acting. Each has its advantages.

A number of elaborate recent examples of modern ocean going, such ships as the turbine reduction geared drive MALOLO and the turbine electric drive CALIFORNIA, have been so thoroughly described in recent issues that it is only necessary to say here that these vessels are for their size the equal of anything afloat.

Marvelous New Inventions

Among other latter day innovations may be mentioned wireless, burning oil as fuel, the gyro compass, the radio compass, fire detecting systems, the automatic steerer and pulverized coal fuel. Wireless certainly is a boon to shipping, as it affords instant communication with ports or distant vessels, and in the quarter century or so during which it has

been in use it has been the means of saving thousands of lives to say nothing of the advantages gained which enable the owners to keep in constant touch with various vessels of their fleets. Burning oil offers a number of advantages.

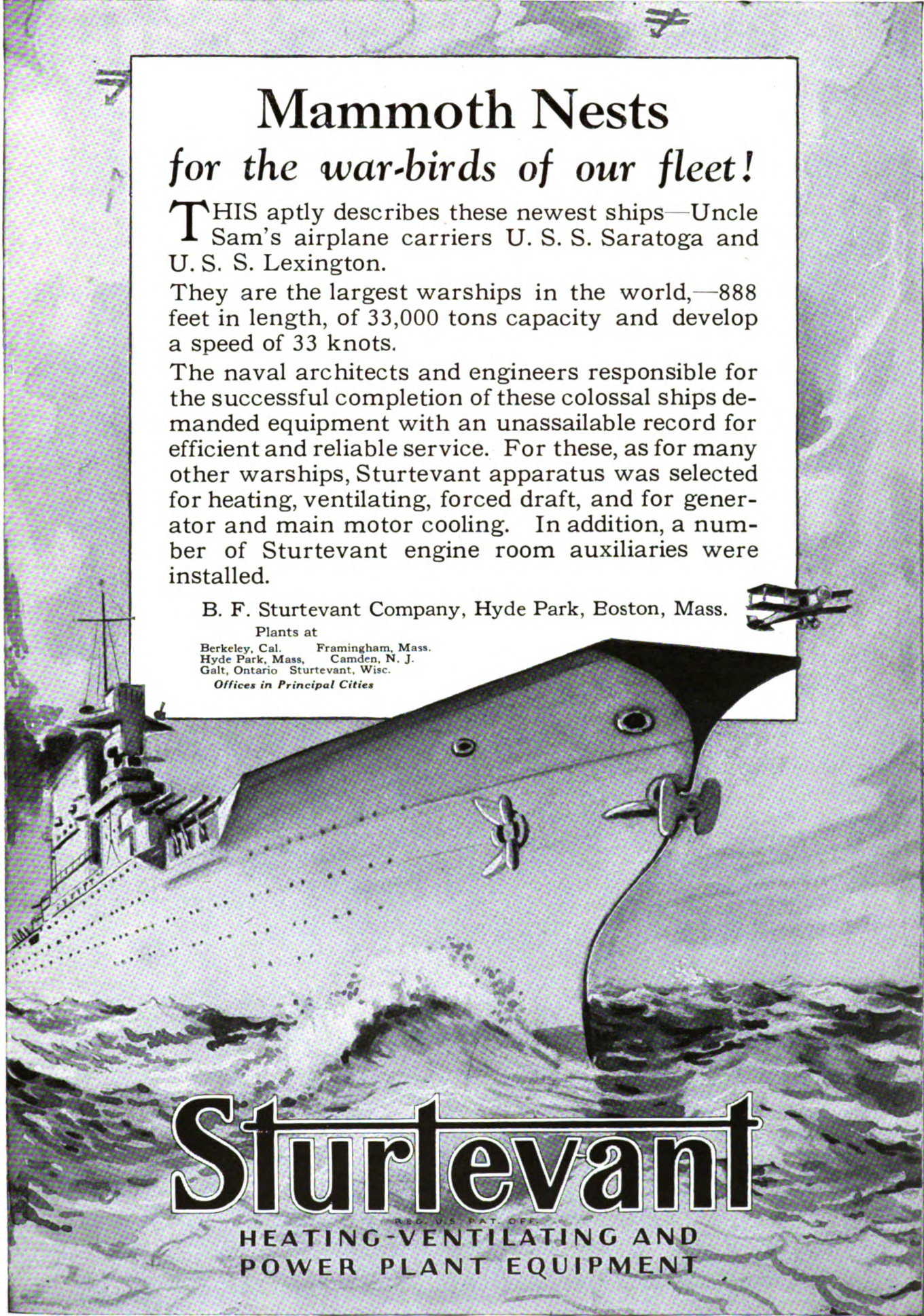
The gyro compass is a great aid to navigation as it always gives a true course and this increases safety. Compass variations, always the bane to the navigator, are entirely eliminated. The radio compass is another latter day improvement which also reduces navigation hazards, as it affords a reliable and efficient means for keeping a vessel on her true course. Fire detecting systems are noteworthy improvements, as they detect burning cargoes instantly and indicate their location.

Modern Aids To Navigation

The automatic steerer is said to offer the last word in vessel operation for once it is set it keeps the vessel on her course automatically. Thus the human element is eliminated entirely.

Pulverized coal as a fuel offers many advantages, in that it can be procured cheaply and burned economically. As it is fed to the furnaces automatically, waste through improper handling is reduced to a minimum. The maritime world is awaiting its perfection in detail with great interest.

What the future holds for shipbuilding no one can predict with a certainty. Both passenger and freight vessels may have reached the limit of length, for in constructing still larger ships docking facilities must be considered. Steam propulsion, with both reciprocating and turbine engines, will probably be employed for years to come. The diesel-propelled ship offers possibilities that may be employed to a constantly increasing extent, while the diesel-electric method of propulsion also appears to have a promising field. Steel ships have come to stay unless some unheard of discovery results in a lighter metal of sufficient strength that can be produced in quantity. Welded ship plates are another possibility. Indeed, several completely welded smaller vessels are already in use and it is claimed that this process is economical when compared with the cost of driving the countless rivets necessary to hold an ordinary vessel together. However, if during the next half century to come progress is as rapid as it has been during the past 50 years, developments are only a question of conjecture, as it remains for coming generations to witness the results.



Mammoth Nests *for the war-birds of our fleet!*

THIS aptly describes these newest ships—Uncle Sam's airplane carriers U. S. S. Saratoga and U. S. S. Lexington.

They are the largest warships in the world,—888 feet in length, of 33,000 tons capacity and develop a speed of 33 knots.

The naval architects and engineers responsible for the successful completion of these colossal ships demanded equipment with an unassailable record for efficient and reliable service. For these, as for many other warships, Sturtevant apparatus was selected for heating, ventilating, forced draft, and for generator and main motor cooling. In addition, a number of Sturtevant engine room auxiliaries were installed.

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HEATING-VENTILATING AND
POWER PLANT EQUIPMENT

Engineering Progress

(Continued from Page 50)

6000 shaft horsepower, and required a special dynamometer to absorb the power. The first commercial application was in the United States collier NEPTUNE in 1911, where it proved a success. Sir Charles Parsons had also been impressed with the value of mechanical gearing for this purpose and he applied it to the machinery of the S. S. VESPASIAN in the same year, the trials of his vessel occurring only a few months after those of the NEPTUNE. This combination of turbines running at somewhere near their highest speed for efficiency and coupled to a propeller running at its suitable speed, have given highly satisfactory results with great economy. Advantage of this was first taken in naval vessels of the torpedo class where actually millions of horsepower in destroyers of all navies have been installed in this shape. When it is realized that 30,000 horsepower in geared turbines with steam supplied by water-tube boilers carrying from 250 to 300 pounds pressure have been installed in vessels of only 1300 tons displacement, it can be realized how enormously weights have been reduced.

Various other methods of reducing the turbine speed to that of the propeller shaft have been suggested and some actually put into use. In our own navy, as a result of the work of Dr. W. L. Emmet of the General Electric Co., with the hearty support of Admiral R. S. Griffin, engineer-in-chief of the navy from 1913 to 1921, an electric reduction gear has been installed in all of our recent battleships and in the two airplane carriers (which were to have been battle cruisers) each of 180,000 horsepower. This is popularly referred to as the "electric drive" and it means that the turbines drive electric generators, which in turn supply current to motors on the propeller shaft. In the case of the airplane carriers there are four shafts, with 45,000 horsepower on each shaft, in two motors of 22,500 horsepower each. Recently this form of reduction has been applied on one of the largest American merchant vessels, the CALIFORNIA, and will also be installed in a sister ship, the VIRGINIA, now under construction.

Early Use of Oil as Fuel

One of the epoch-making changes in marine steam machinery came with the use of oil as fuel, replacing coal. Here, again, the introduction of what has come to be a vital element was delayed for a considerable period largely by inertia but also by the

necessity for the perfection of details. As far back as the 80's of the last century what was known as "astatki" or petroleum refuse from the distilling plants at Baku on the Caspian sea had been used under boilers operating in that region. Attention had been given to the subject elsewhere but the amount of fuel oil available was not sufficient to lead to its introduction. The early forms of burning oil on shore by means of steam jet or compressed air were not suitable for marine service, although careful investigation was made of the possibilities. Admiral Melville appointed a board of naval officers, who ran a very elaborate series of tests with oil fuel, using compressed air and steam atomization. The result of their work contains much valuable data but it did not directly advance the use of oil fuel on board ship. When it was found that, under pressure with a suitable nozzle, an oil spray could be formed which burned perfectly, an immediate impetus was given to the application of oil for use on board ship, this method being known as mechanical atomization.

Many Oil Burners Developed

Many different forms of burners (and many of them good) have been developed and also methods of providing a thorough mixture of the air, necessary for combustion, with the oil spray. Here, again, the navy was the first to take advantage of this new element. It has had the most striking effect in enabling vastly greater power to be installed in the same space than could have been done with coal. All of the high powered vessels to which I have referred are oil burners. A few years ago, in an address before The Society of Naval Engineers, I called attention to this point, as follows:

"It is safe to say that the modern vessels of extremely high speed, like the destroyers and scout cruisers and the proposed battle cruisers, would be impossible with coal. The weight of boilers required with coal firing would of itself be prohibitive, and the force of firemen and coal heavers would be entirely out of the question in the room available.

"In the old days an air pressure in the fireroom equivalent to 2 inches of water was considered high and this secured a combustion of about forty pounds of coal per square foot of grate. In the destroyers and other high powered oil burning ships, air pressures are carried as high as 7 or 8 inches. Locomotive experiments show that such an air pressure with coal would, while the fires are clean, burn about eighty pounds of coal per square foot of grate, but even at this exceedingly high rate it would require at least two boilers with coal for one with oil burning in order to

get in the necessary grate surface."

Oil fuel is now used on nearly all modern vessels in the merchant service as well as in the navy. There is always the fear that the oil supply may give out, so that efforts to utilize coal in some better fashion than by hand-firing are continually under consideration. It is worth noting, too, that what might seem at times like a small variation in the cost of oil may make it very much more expensive than coal. There is a simple relation between the cost of the two which I happened to formulate some fifteen years ago and which some have called "McFarland's law." It is this:

"When the price of coal in dollars per ton is twice the price of oil in cents per gallon the cost for fuel under a boiler is the same."

This means, of course, that oil at 3 cents per gallon is the same in cost as coal at \$6.00 per ton. Bunker oil has been selling at more than 4 cents a gallon, while coal could be bought for \$5.00 or \$6.00 a ton. There are also the advantages of cleanliness, reduced fireroom force, ease of manipulation and many others in favor of the use of oil.

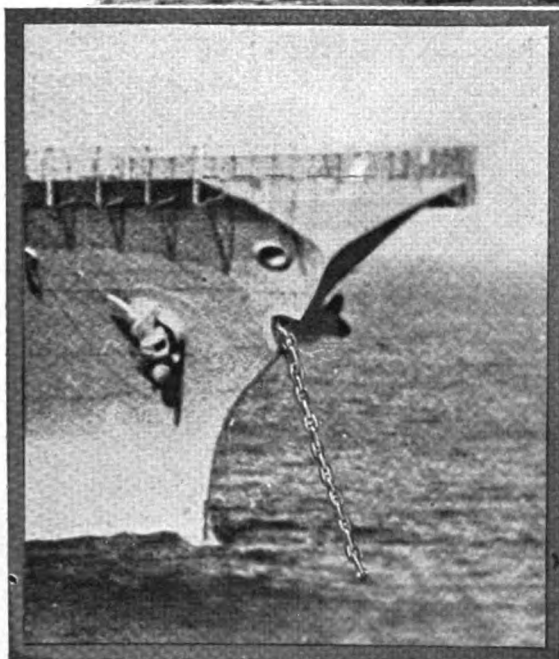
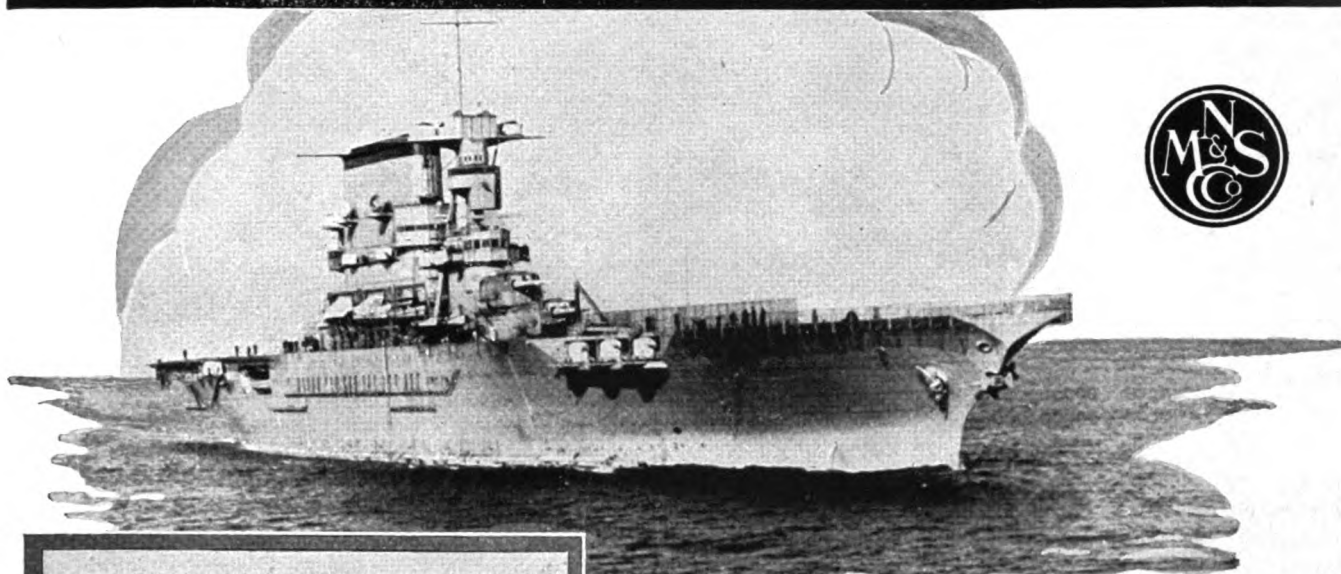
Experiments have been conducted recently to determine the availability of pulverized coal for marine use. All engineers know that this form of fuel has been used for a long time in the cement industry and also in certain places under boilers. It is by no means a simple problem and, while definite progress has been made, it certainly cannot be said that there is such assured satisfaction in the marine use of pulverized coal as to induce any superintending engineer to enter upon its adoption lightly.

Methods of Burning Coal

In the great power houses on shore, for many years past, coal has been burned on various forms of mechanical stokers with great satisfaction. Hitherto, it has seemed that limitation of space would prevent the introduction of stokers on board ship. Recently, however, the desirability of burning coal by means of stokers has made some shipowners willing to give up more room to the boilers. Experiments are now under way with stokers which look very promising. Handling coal at the rate of 40 pounds per hour per square foot of grate surface was considered about the maximum which men could be expected to do. This, however, is much below the rate at which stokers are working as a regular thing, day after day, in shore installations.

Reference has been made to the refinements in connection with boiler

“NACO” On the Aeroplane Carriers **U.S.S. Saratoga & U.S.S. Lexington**



The Aeroplane Carriers, U. S. S. Saratoga, and sister ship U. S. S. Lexington, recently commissioned for service in the United States Navy, are equipped with Naco Cast Steel Anchor Chain Cable; The only commercial chain in which the Stud and Link are cast in one solid piece.

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practice on shore which have led to the present high efficiencies and it is interesting to note that most of these are being adopted in nearly all of the new installations on board ship. This refers particularly to the use of superheat and of air heating and feed water heating. Superheating is by no means new and was actually in use before the advent of the compound engine. It is probable that the increase in economy due to the compound engine, combined with the trouble due to corrosion in superheater tubes led to its abandonment at that time. In recent years, however, the increase in economy to be obtained from superheating has led to its adoption, as a number of vessels are now using superheats as high as 200 degrees and 250 degrees to give a total temperature to the steam of from 725 degrees to 750 degrees.

Waste Heat Is Utilized

The fact that boilers when worked at high rates of combustion would have stack temperatures of 600 degrees and higher has naturally led marine engineers who are familiar with land practice to feel that some of the devices used on land should be adopted on board ship to save heat. The most progressive designers today are using superheat and air heaters. Feed water heating has, of course, been a common practice for many years, but in recent times the effort has been to bring the feed water temperature more nearly up to that of the water in the boiler. With the advent of the turbine and the search for economy in the power house, what is known as stage heating of the feed water, by tapping the turbine at various places, has been carried out with an increase in economy. The complication involved in the piping necessary has thus far discouraged the use of this device on board ship.

For many years steam was practically the only motive power available for any form of marine craft, even the smallest. When the gasoline engine became thoroughly developed and reliable, it gradually displaced steam entirely in small marine craft. There is apparently a limit to the size of gasoline cylinders which will work with satisfaction so that their use has never been practical for large powers and has never been considered for large vessels.

More than thirty years ago, Dr. Rudolph Diesel invented his engine, of which the essential feature is the ignition of combustible gases or sprays by high compression. Such tests as he had made showed a thermal economy which was enormously in advance of anything possible at that

time with steam. I well remember that in 1897 I heard the late Col. E. D. Meier, who had spent about six months in Europe studying the diesel engine, make an address in which he stated that the merits of the engine were so great that he believed it would not be many years until steam engines would only be found in museums. Events have proved that he was over sanguine. It had apparently been assumed by Doctor Diesel and his enthusiastic followers that there was nothing to prevent the use of diesel engines of any size. As a matter of fact, for a long time after Colonel Meier's address, very little was heard of the diesel engine but the development process continued.

Beginning about 1910, which date apparently is coincident with the expiration of the diesel patents, this motor took on new life, and since then has been extensively used and developed under the auspices of some of the best engineers in the world. There is no question about the great thermal economy, which is of the order of 30 to 35 per cent, but there are some very decided drawbacks which non-enthusiasts cannot fail to see on a little study. The power in a single cylinder is decidedly limited. It may be said, in general, that except for special forms which are really two cylinders in one and having two pistons, the maximum horsepower from a single cylinder is not over 500. With powers in great liners and battleships running anywhere from 70,000 to 150,000 horsepower it can readily be seen that the multiplicity of parts resulting from the use of diesel engines would be prohibitive.

Diesels on Large Vessels

There are some large vessels with considerable power, say, 25,000 horsepower as a maximum, which are using diesel engines, but there are few of them. If all other things were equal, and we compared the high thermal economy of the diesel engine with the much lower economy of the ordinary marine steam installation, there would be no question about the diesel engine superseding steam plants.

It is interesting to note that the diesel engine gets a shaft horsepower for 0.45 pound of diesel oil per hour. Some of the most modern steam plants are getting a shaft horsepower for 0.70 pound of bunker oil per hour. Diesel oil regularly sells at from 30 per cent to 50 per cent more than bunker oil and sometimes even higher. With steam at 500 pounds and the suitable modern features of superheating, air and feed heating, the steam performance will

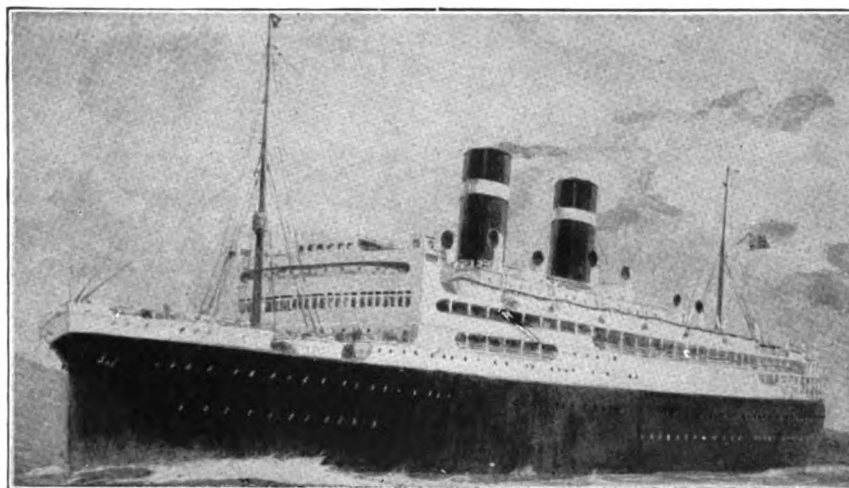
be about 0.60 pound per shaft horsepower per hour. If the diesel oil costs one-third more than bunker oil, the money cost of a shaft horsepower for fuel, only, would be the same in the two cases.

Just as the gasoline engine has made a place for itself, which it fills admirably, so it is probable that, when the hysteria about the use of the diesel engine subsides, a field for its profitable use will be found to which it will be limited. One beneficial effect of the introduction of the diesel engine has been to compel ship owners to consider the advantages of steam plants with the latest modern features for securing economy. The benefits of superheat and many of the other features which are now adopted almost without question have long been known, but it was very difficult to persuade operators to adopt them. When there was nothing more economical actually in use, they were inclined to be satisfied with what they had and about which they were thoroughly posted. The thermal economy of the diesel engine certainly gave them a jolt and we are seeing the benefit of that now.

Higher Pressures and Temperature

In conclusion, it is a great satisfaction to one who has had the privilege of living through this period, of association with many of the famous leaders in marine engineering, and of having had some active part in the work of improvement, to feel that there has been steady progress, slow at times, but still a steady advance, during the half century. Just what course further progress will take is not entirely clear. Higher pressures will certainly be used, with total temperatures up to at least 750 degrees Fahr. Beyond that point, increased temperature adversely affects strength. Possibly the metallurgists will help again, as they did fifty years ago with mild steel. One thing is sure. Today our engineers are far better equipped professionally than they were fifty years ago, when "rule of thumb" methods still prevailed to what, in looking back, was an alarming extent. They have open minds, and we may confidently anticipate that the next fifty years will also be a record of the triumph of the engineer.

Results of operation of the International Mercantile Co., and its subsidiaries for 1927 shows a surplus of \$561,054 as compared with a deficit of \$1,483,139 for 1926, after insurance, taxes, bond interest, depreciation and general operating expenses.



S.S. California

Smart Looking

- □ -

Built to wear---
"LIKE A
BATTLESHIP"

S.S. California, largest merchant ship ever built in the United States, is in every respect comparable to the finest transatlantic ships now in service. She will run between New York and California ports, her turbo-electric drive giving a speed of 18 knots.

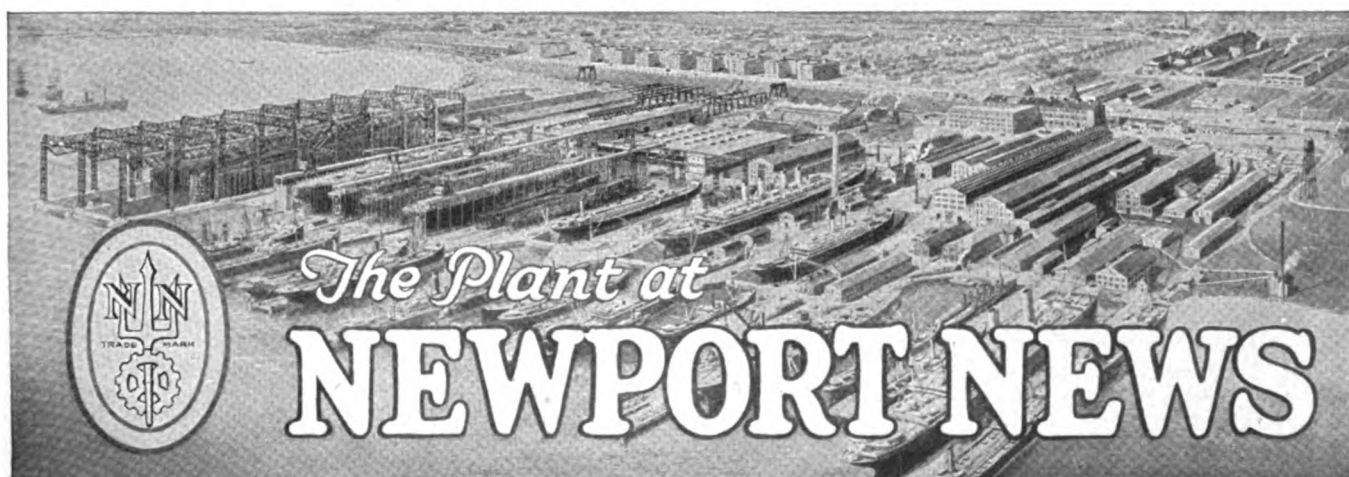
Newport News Shipbuilding and Dry Dock Company ranks as one of the finest organizations in the world, in facilities for construction and repairs.

Our yard facilities are unequalled, labor is plentiful and good, and the climate permits outdoor work the year 'round.

- ——— -

If you desire fine ships, or are in need of quick dependable repair service, our Engineering staff will be glad to consult with you—without cost or obligation.

NEWPORT NEWS SHIPBUILDING AND DRY DOCK COMPANY
NEWPORT NEWS, VIRGINIA, U. S. A. - NEW YORK, 233 BROADWAY



Famous American Ports

(Continued from Page 63)

Only four foreign lines operated from the port fifty years ago. Vessels of other lines also provided irregular service. At the present time 38 regular overseas steamship services operate vessels on schedule from all important world markets; 10 steamship lines operate on regular intercoastal service via the Panama canal to all important Pacific coast points; and 13 steamship lines operate in regular coastwise service to all important ports on Atlantic and Gulf coasts and on Chesapeake bay.

The Federal government, the state of Maryland and the City of Baltimore have expended to date approximately \$25,000,000 for expanding the facilities and services of the port. In 1920 the state authorized the city to expend \$50,000,000 "for the purpose of developing, expanding and improving the harbor of Baltimore and its facilities." A port development commission is functioning under this authority and has devised a definite program of procedure. Construction of new ocean terminals is already in progress.

The total foreign and domestic commerce of Baltimore has risen from 13,200,000 to 22,900,000 short tons of cargo in the last five years, while the valuation of Baltimore's total port business has risen in the same period from \$575,000,000 to \$932,000,000.

Port of Norfolk

NORFOLK after the World war created a Hampton Roads Maritime exchange for promotion of the port's interests. In 1925 or 1926 the state of Virginia created the Port of Hampton Roads authority devoted to the unification and promotion of the various elements of the great area known as Hampton roads. The growth of Norfolk is described by H. M. Thompson, secretary of the Hampton Roads Maritime exchange for the fiftieth anniversary number of MARINE REVIEW.

Norfolk on Hampton roads has always been a seaport city. In the early colonial days, ships traded between the West Indies, Bermuda and United Kingdom ports and the Hampton roads-Chesapeake bay ports. An important factor in the development of the port was the discovery of bituminous coal in southwest Virginia and West Virginia. First movement of coal from what is now the famous Pocahontas section of West Virginia, old records indicate, was sent through Norfolk in 1883.

In the year 1884 the first modern coal pier in the Hampton roads ports

was constructed at Lambert's point and the first regular shipment was sent from this pier in March, 1885. At the time it was the world's largest coal pier. Today three great coal carrying railroads, the Norfolk and Western, Virginian and Chesapeake and Ohio, with the most modern coal transshipment facilities in the world, handle annually more than 25,000,000 tons of coal through the ports.

The ports of Hampton roads, Norfolk and Newport News possess natural proximity to deep water. Continual deepening of the main ship channel has given a depth of forty feet. Easy access for big ships together with modern transshipment and storage facilities have caused the building up of a great coastwise, intercoastal and foreign steamship business at these ports.

Eight trunk line railroads enter the port from the northwest and south and an excellent belt line railway links all of these roads with the water transportation systems through steamship wharves and a municipal union terminal, where ships can receive and discharge their cargoes directly to and from the freight cars of all the roads. The belt line is owned jointly by the eight railroads and it provides for an efficient interchange of traffic from one road to another, serves industry and commercial establishments and connects with steamship terminals.

Having faith in its future following the extension of the belt-line railroad to the Norfolk side of the Elizabeth river, the city of Norfolk erected a modern terminal, comprising a grain elevator, piers, and warehouses, at a cost of nearly \$6,000,000. This terminal is operated in conjunction with the army base under lease, as a union terminal. There are nine open and sixty-two covered piers in the harbor having car capacity on the tracks for 4548 cars, over 10,000,000 feet of covered storage space, and berthing capacity for 168 vessels. The business of the port has increased since 1914 counting both export and import from \$22,258,677 to \$209,520,000.

Port of Charleston

CHARLESTON is the only harbor seaport on the south Atlantic. Geographically it is almost an exact replica of the port of New York only about one-quarter the size. Since earliest colonial days it has been important; and the commerce of Charleston in indigo, rice, and cotton brought to it a great reputation as the shipping center of the South, as well as the cultural center because of the generations of wealthy families engaged in planting and shipping from the Carolinas.

The Civil war or the war between the states as it is known in Charleston left South Carolina about the most completely prostrate of all the southern states and the port of Charleston lapsed into decay. The entire Southeastern coast suffered from the lack of railways and rail rates from the great interior during the 60 years of the phenomenal railway and industrial development of the great Middle and Far west of the United States.

From central freight association territory the rate to Charleston or Savannah was the rate to Philadelphia or Baltimore plus the local rate to Charleston. The injustice may be seen from the fact that St. Johns, N. S., 1400 miles farther from Chicago than New York had the same rate that was denied to Charleston or Savannah only 109 miles farther.

The first sign of development came in the eighties when the United States government constructed the jetties at the mouth of the harbor which made it possible to increase the depth from 18 to 25 and eventually to 30 feet at mean low water. Thirty feet at mean low water with the present dredging of 32 feet means 36 to 37 feet at high tide. From the lightship the channel is 600 feet wide with 1000 to 1500 feet in the three principal bends. Charleston is the most easily accessible port on the Atlantic coast in any wind, storm or tide. A 40-foot channel has been authorized.

Port Is Growing Rapidly

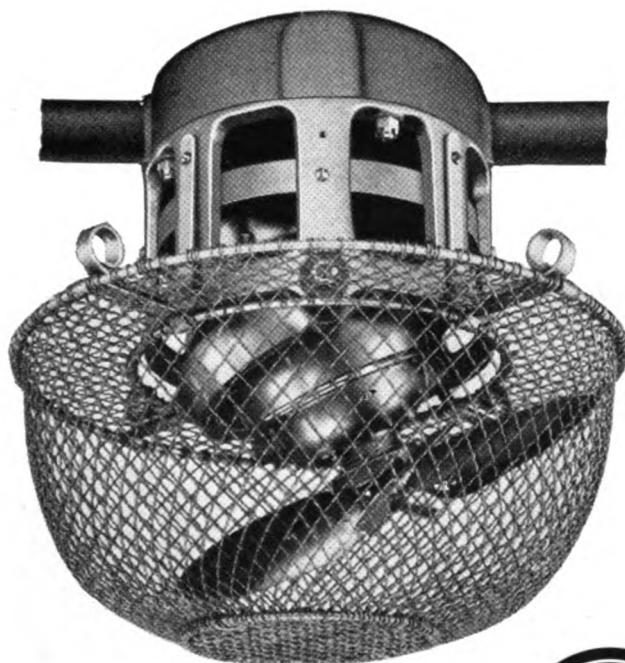
In 1920 the railroad administration established rates to the south Atlantic ports at a small differential under the north Atlantic ports from central freight association territory. This slight advantage is an encouragement to the decentralization of exports and to the use of all available ports. However, the main reason for the growth of Charleston is due to the development of the South as an industrial center and not from traffic diverted from north Atlantic ports.

After the World war the city decided that the waterfront should be developed as a community asset. The city issued bonds and purchased the Charleston Belt railway along the waterfront including a number of old piers. A new municipal pier known as the Union pier was built for coastwise and intercoastal trade and the Columbus street marginal wharf was extended and improved for fertilizer products. The port terminal or army supply base constructed by the government has been leased and is operated by the city.

A port utilities commission was created by the city for the adminis-

DIEHL FANS

for MARINE SERVICE



THE NEW GYROCONE CEILING FAN

A standard time tested item of the Diehl line now presented for marine service. Especially adapted for salons, reception rooms, dining rooms, ball rooms, etc., and wherever complete air distribution without direct draft is essential.

Scarcely larger than a bracket type fan the Gyrocone completely and more efficiently performs the duty heretofore assigned to large blade ceiling fans.

Mounted in a ball bearing pivoted cradle, a sturdily built twelve inch, four blade fan gyrates through full 360 degrees at an angle of 27 degrees from vertical providing a total sweep of air of 54 degrees. Eight complete revolutions per minute at high speed circulate air over a greater area than is possible with other types of fans. Operating parts are enclosed in dust-proof iron housings and all moving parts are ball bearing equipped. Lubrication reservoirs are sufficient to insure continuous operation, under normal conditions, over a period of two years. A sturdy wire mesh guard with openings not larger than $\frac{1}{2}$ -in. completely surrounds the blades.

MARINE TYPE 12 and 16 INCH FANS NOW IN USE ON THE S. S. "AMERICA"



Diehl Marine Type Fans as now used on the S. S. "America" are especially designed for service on shipboard or where subjected to sea air. Graceful and well proportioned they harmonize readily in most any surroundings and deliver a large volume of air with unusual quietness and absence of vibration. Particularly noteworthy are the following features:

- (a) Blades of solid brass or monel metal.
- (b) Guards plated with brass and japanned.
- (c) Motors entirely closed and dust-proof.
- (d) Windings specially insulated and impregnated to resist action of sea air.
- (e) Rheostat, small parts and fittings of non-corrodible and non-absorbent materials.
- (f) Special insulation, to guard against action of sea air and to resist moisture of tropical climates.



Write for information and prices

DIEHL MANUFACTURING COMPANY
ELECTRICAL DIVISION OF THE SINGER MANUFACTURING COMPANY
ELIZABETHPORT, N. J.

tration of funds appropriated for the construction of port facilities, and to operate and maintain them. A port promotion bureau, a bureau of port development and even earlier, a traffic bureau have been established. Several large shipping firms such as the United Steel Corp. and the United Fruit Co. established shipping bases at Charleston while several oil companies, the foremost being the Standard Oil Co. with a \$15,000,000 refinery, have also located there.

Results as shown by statistics are remarkable. In tons of freight handled in foreign commerce in 1926, Charleston is almost equal to Jacksonville and Savannah; a rise from thirty-fourth in 1923 to fourteenth place in 1927 in the list of United States ports. From 1918 to 1927 the value of foreign trade increased 807 per cent.

Port of Mobile

MOBILE, Ala., is another example of an old southern port taking on new life. The reason for its renewed existence is the great steel industrial area around Birmingham and connection of that area by water through the government Mississippi-Warrier services on the Warrier river. Also the activities of the Louisville and Nashville railroad in bringing coal to its terminal at Mobile is an important factor.

Completion of the conspicuous terminal construction, costing \$10,000,000, appropriated by the state of Alabama, was celebrated with pomp and ceremony June 25. These terminals together with good private terminals make Mobile one of the best equipped ports in the South. The United States government following the policy of helping those who help themselves will improve the channel.

Port of San Francisco

SAN FRANCISCO represents an outstanding example of methodical public port development. It began as an important port with the gold rush in 1849, but does not appear in the governments statistics for that year.

Fortunately the channel requires very little permanent improvement. There are three natural channels through the bar outside the Golden gate, the South, Main and North channels, having normal depths respectively of 33, 35 and 59 feet. No work has been done in the South channel while the work in the North channel has consisted in removing isolated pinnacles of rock. To provide a straight entrance channel of sufficient depth the war department has dredged the Main channel through the bar, increasing the depth to 40 feet at

mean low water, with a width of 2000 feet. Inside, the harbor is of great depth.

Fifty years ago none of the permanent sea wall around the active water front had been constructed. At the present time it extends continuously from the foot of Taylor street on the west to Channel street on the south and from Channel street to El Dorado street, a total distance of approximately 4 miles. A state belt railroad serves the port terminals and adjacent industries. It now operates over a main line nearly five miles in length with a total trackage of 58 miles and operates 24 hours a day.

Coastwise and intercoastal shipping have been conspicuous in recent developments. The Pacific coast ports of Seattle, Tacoma, Portland, San Francisco, Los Angeles, San Pedro and San Diego are all profiting by the animated commerce with the Atlantic seaboard. In the year 1878-79 the capital expenditure for port development for San Francisco was \$213,000. In the year 1927-28 the capital expenditure was \$1,081,000. In cargo tonnage for the fiscal year 1927-28 San Francisco had a total in the various categories of 10,845,914 tons.

Port of New Orleans

NEW ORLEANS is situated more than 100 miles from the Gulf of Mexico on the Mississippi river. The river is very deep and the government maintains a channel through the delta. It may be said that the modern growth of this port began May 29, 1901, when the board of commissioners of the Port of New Orleans, a state organization, took over the operation of the port. This is a remarkable story of public spirited enterprise. Beginning with \$17,000 in the treasury and with considerable credit in New Orleans banks due to the responsible character of the members of the commission, it began to build up a wharf system which in twenty-seven years has grown to an immense property with a book value of \$50,000,000 and an actual value of perhaps \$100,000,000, besides a surplus of nearly \$10,000,000.

The old wharf system taken over from the city consisted of wooden landings with two or three wooden sheds, all in bad condition and urgently needing repairs. The first contract was let for a 900-foot coffee wharf at Henderson street covered with a steel shed the entire length. The United Fruit Co. began its extensive operations in the port in the same year. In 1904 the state authorized \$2,000,000 for port improvement bonds. Construction progress from

then on was rapid so that in 1910, 25,561 lineal feet of wharves with an area of 2,231,980 square feet and 16,778 feet of steel sheds with a transit storage of nearly 2,115,000 square feet were available. The growth has continued steadily to this date, with nearly 40,000 feet of wharf frontage, approximately 7,000,000 square feet and over 30,000 feet of modern steel sheds, embracing nearly 5,000,000 square feet of transit storage area.

Special facilities include the first public cotton warehouse, costing \$6,000,000. Then followed the construction of a modern public grain elevator and finally \$20,000,000 were expended in providing the inner harbor navigation canal for commercial shipping and for industrial purposes. The New Orleans public belt railroad started operation in 1905 and has progressed steadily, giving service between all railroads and all wharves.

In 1900 when the board began operation foreign commerce totaled \$133,350,000 while in 1927 the value had increased to \$552,000,000. Coastwise intercoastal and river commerce has increased in a like manner.

Conclusions

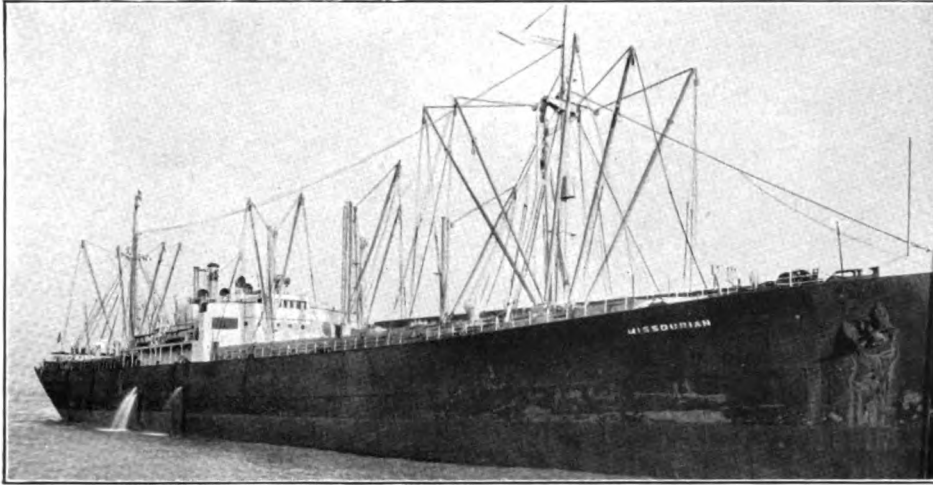
KEEPING step with the tremendous progress in prosperity, productive and consumption capacity of the United States and with the ever increasing size of ocean vessels, the ports of the country around the periphery of our three coasts through the states and municipalities have set forward and spent great energy and treasure in meeting the demand of waterborne commerce.

The great developments started about 1900, but the acceleration and the principal achievement came with and immediately succeeding the World war. The monumental wharves and piers that now serve commerce at our principal ports are as different from the marine terminals at the time when the MARINE REVIEW was founded as the LEVIATHAN and BERENGARIA are different from the PINTA and SANTA MARIA.

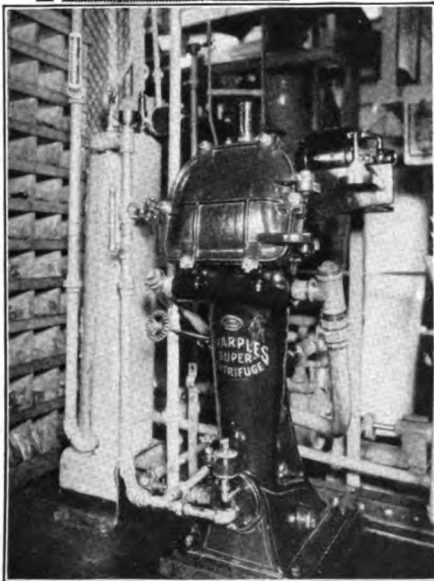
We are at the beginning of the port development era. The Great Lakes have not yet started in general cargo development but are beginning to think about it and if the St. Lawrence shipway becomes an actuality, which it undoubtedly will, making another Mediterranean sea of the Great Lakes, we will find at the Great Lakes cities an era of port development that will far over-shadow what has been done around the coasts, because it must be done quickly and because it can be based firmly on the foundation of the experience in these older ports.

A MOTORSHIP FLEET SHARPLES PROTECTED

OWNED AND OPERATED BY AMERICAN HAWAIIAN STEAMSHIP CO., SAN FRANCISCO.



THE
M. S. "MISSOURIAN"



←— This Machine
centrifuges all of the fuel oil used in both main
and auxiliary engines of the "Missourian".

105 bbls. per day—12 hrs. per
day average running time.

A duplicate of this machine is running an
equal amount of fuel aboard the M. S.
"Californian", sister ship of the "Missourian".

Chief Engineer Connal says:—

"Since the installation of the Sharples in May, 1927, valve maintenance has been cut in half. Machine work on valves has been unnecessary and grinding greatly reduced. Fuel pump packing lasts three times as long. Piston blow-by is entirely eliminated. Life of auxiliary engine exhaust valves increased four times. Main engine liner wear cut more than half."

*For ten months' operation the solid matter removed averaged
one pound to each ten barrels of oil*

SHARPLES

A GREAT FORCE

THE SHARPLES SPECIALTY COMPANY, 2338 Westmoreland St., Philadelphia

Marine Insurance

(Continued from Page 69)

representation here, and located in some foreign markets, principally London. The hull business, which is the insurance on vessels themselves, on coastwise and even in many cases inland fleets, was placed mainly in other markets, principally London, and such portion as was placed here was placed on the terms arranged in London, the risks coming to American underwriters on the basis of the terms agreed in London, concerning which they had no voice. Indeed many fleets had the small proportion placed in this market placed without the terms being divulged, but simply London conditions.

"From that time on there came a steady but slow growth of the American market, and this was at the beginning much more noticeable in the cargo business of which this market took a larger and larger share, until for the last ten years a very small portion of the American cargo business has been placed outside of the American market.

"In the hull business the growth has been slower. During the period 1895 to about 1902, there was little if any change in the situation, but after 1902 a very considerable change took place. A larger proportion of this business was placed on this side, and gradually the American market began to have not only a growing share of the values, but a continuously growing share in determining the terms upon which the fleets were written; until, at the present time, while this market is in competition with the foreign market yet, it is, while not the sole, still the most important factor in determining the rates and terms of American fleets, and it also insures the larger and growing portion of the American hull values. When it is considered that the insured values of vessels have advanced from 50 to 150 per cent, that the prices of principal exports and imports have increased to several times their former value; as example, cotton per bale from \$60 to \$200, wool from \$110 to \$800 a bale, it will be seen what development the market here has shown. A considerable proportion of this increase has been borne by the foreign companies maintaining American organization, only partially offset by the forced withdrawal of the very considerable German facilities that existed here at the beginning of the war. The greater increase, however, has come from American companies."

Carefully prepared statistics submitted by Mr. Chubb when he made his address in 1918, indicated the great expansion which occurred in the marine insurance business in the United States in the first two years of the war due to the tremendous demand for war risk insurance. These figures are given in Table 1.

Market conditions in marine insurance have been highly unsatisfactory most of the time since the end of the World war, not only in the United States but throughout the world, and the losses sustained in the writing

of marine insurance have been heavy. The cause of this condition is the entrance of so many new interests into the field, so that on the conclusion of the war there were many companies soliciting business and not nearly enough business to go around. It may be said, however, that the period of destructive competition seems to have run its course. The wild downward plunge of premiums appears to have been permanently arrested during the past year. Of late there have been some slight advances, although these have been restricted to certain classes of business which have reflected unusual hazards.

Growth of Reinsurance

On the whole, the market in marine insurance now reflects a much better tone. With the legislation which recently has been adopted, it may be said that the marine insurance business in this country is in the healthiest state in its history and high hopes are held that American marine insurance companies will be able to show increasing prosperity.

A feature of interest among developments in recent years was the organization of the first cotton reinsurance association in 1909. Since then another such agreement has been placed in operation and two cotton reinsurance associations now are functioning. These greatly facilitate our trade in this important commodity. Last year a burlap reinsurance association was organized and this is in satisfactory operation. Attempts have been made from time to time to organize reinsurance syndicates with respect to other commodities but they have failed, for the reason that reinsurance agreements do not prove successful unless there is enough concentrated value in the agreement to give everybody a satisfactory interest. In other words, it is only in connection with commodities whose value entails a great amount of money and which call for great quantities of insurance that reinsurance agreements have been successful.

Another feature which had an important effect on the marine insurance business in this country during the last 50 years was the legislative attitude which existed prior to the law which became effective in Washington in 1922. Thitherto, marine insurance was regulated in accordance with the same laws that applied to fire insurance. For a long time, it was illegal in New York state for companies to engage in writing of both fire and marine insurance; they had to write one or the other. This restriction was removed in 1911.

One of the important developments during the past half century is that many of the bulk freighters on the great lakes are insured by a mutual association. This was organized many years ago and is known as the Great Lakes Protective association.

Figures published by the insurance department of the state of New York show that in the year 1878, when the MARINE REVIEW began publication, there were 59 domestic companies and 11 foreign admitted companies writing marine insurance in the United States. That year the ocean and inland marine insurance written was \$13,174,195 by the domestic companies and \$1,165,340 by the foreign admitted companies.

To show the amount of marine insurance business written in 1927, the following statistics in Table II were compiled by the Alfred M. Best Co., Inc., 75 Fulton street, New York.

These statistics do not include a great deal of marine insurance which is placed by cable with foreign companies not admitted in the United States. There are various estimates as to how much business is cabled abroad to foreign non-admitted companies, and the general belief is that it is at least 25 per cent of the total. It roughly is estimated in marine insurance circles that about two-thirds of the insurance is in connection with cargoes, while hull insurance forms the remaining one-third. It further is figured roughly that about two-thirds of our hull insurance is cabled abroad to non-admitted companies, while about 10 to 15 per cent of our cargo insurance is cabled abroad. These estimates are not set forth with the intention of giving an accurate picture, but merely to convey an approximate impression of the amount of marine insurance going to foreign non-admitted companies. It is the belief among those in the business, however, that the business cabled abroad shows a decreasing tendency at the present time.

The statistics given above for the year 1878 embrace both ocean and inland marine risks, but it may be said that only a small portion of the total business written that year involved inland risks. The statistics prepared by the Alfred M. Best Co., therefore, reveal the great growth in the importance of the inland business. It is believed in the marine insurance business that further great growth may be expected in the inland branch of this business for the reason that high railroad freight rates are causing shippers to use inland waterways in every way possible.



“Double Reduction Gears in Entirely Satisfactory Condition After 844,707 Miles”

THE Munson liner MUNARGO, built by the New York Shipbuilding Co., went into regular service on the New York—West Indies route in 1922. A single screw is driven at 85 r.p.m. through a DE LAVAL 5800 s. hp. DOUBLE REDUCTION GEAR, shown above with the covers removed.

A report of a routine inspection of these gears made on April 27, 1928, preliminary to a reconditioning of the vessel, contains the statement quoted in the headline of this advertisement, and adds “there is nothing to do to the gears as they are in first class condition”.

The uniformly successful operation of De Laval double reduction gears is due to:

- (1) Accuracy in cutting.
- (2) Adequate, rigid support.

- (3) Conservative tooth and bearing pressures.
- (4) Highest grade materials and workmanship.
- (5) Careful manufacturing inspection.

The record of the MUNARGO is representative of experience with De Laval Marine Gears.

State character of vessel in which you are interested, so that our engineers may make suitable recommendations and refer you to installations on similar vessels.

De Laval

Steam Turbine Co., Trenton, N.J.

Atlanta
Boston
Charlotte
Chicago

LOCAL OFFICES:

Cleveland
Duluth
Havana
Helena

Honolulu
Houston
Kansas City
Los Angeles



Montreal
New Orleans
New York
Philadelphia

LOCAL OFFICES:

Pittsburgh
Portland, Ore.
St. Paul
Salt Lake City
Spokane

San Francisco
Seattle
Toronto
Vancouver

762

Manufacturers of Steam Turbines, Centrifugal Pumps, Centrifugal Blowers and Compressors, Double Helical Speed Reducing Gears, Worm Gears, Hydraulic Turbines, Flexible Couplings and Special Centrifugal Machinery

Diesel Engine Progress

(Continued from Page 71)

the eastern districts where coal is proportionally cheap. Most of the engines are sold in western districts where the real oil industry is located. A great number of engines are used in ship propulsion. For real large units—if they should be built—the field to a great extent has yet to be opened. Obviously large diesel engines will be used in power houses as standbys to take care of "peak loads."

The diesel locomotive has a special significance for America. It must come to pass under any condition in a few years, not only in small but also in large units, as soon as laws, which are now in preparation, prohibiting the use of the steam locomotive in the environs of the large cities, are enacted. The first motor locomotive in the form of a rail car was put in operation in 1917 in the General Electric works, Schenectady, N. Y., with a gasoline engine of 300 horsepower. This unit which had electric transmission to the wheels, performed well as a switch engine. Since then diesel locomotives with Ingersoll-Rand diesels of 600 horsepower have been built and delivered by the American Locomotive Co. One of these locomotives which we inspected had worked excellently. The four-cycle diesel engine resembles our German types although it is less developed and very heavy. Nevertheless, one gains the impression that some experience in this direction has been gained. Any noise from the exhaust and from the working parts was hardly audible outside so that the locomotive engineer was able to pick up all orders necessary for handling the engine. We have been told that twelve of these locomotives for switching service are already being used and that fifteen hundred dollars per month is being saved on each locomotive. In the meantime a further commitment of one hundred locomotives is under way in the same factory.

The firm of J. G. Brill of Philadelphia has made considerable progress in the field of railroad motor cars. One hundred rail cars have already been manufactured by it. The experience with this type of vehicle has been excellent and is encouraging to further exploitation. These rail cars are used principally in the United States to handle traffic between smaller cities, suburbs, etc., and in larger cities connecting with the main lines. Here the need of a diesel engine of equal power and reliability as the highly developed gasoline engine, is deeply felt.

In general, it may be said that the

diesel engine in America has reached a high point of development, but nevertheless, it will take several years before it will be as highly developed as engines of European, and especially of German origin. But one should not forget that there are in America, first class plants building diesel engines and these firms are displaying in their developments and simplicity of style, all the energy and courage which have been in evidence in other American enterprises. America, however, will have to utilize further and to a larger extent, German science and German spirit as a basis for her work. There is much scientific research work to be done and there are problems in the field of the large diesel engines, as well as the light weight oil engine to be solved, particularly in the latter, as Americans have been too much accustomed to build and construct heavily as mentioned above. American industry is conscious of the difficulties in building high grade engines of the lowest weight, a necessity for locomotives and motor cars, and therefore America will need in the future more than ever, the co-operation of European and especially of German firms and the use of their experience.

Frequently we find here in Germany the inclination to overestimate American achievements and to imitate slavishly American example. To give way to this disposition is just as wrong in my opinion as to ignore all the good which the Americans have so far accomplished. Indeed the ideal to be obtained is everywhere pursued with ardent fervor in order to find the best solution in the simplest way, and in this Americans are aided in a natural way by their practical disposition and sound common sense. In this respect "Americanization" means to me nothing more than simplification. Although our field of possibilities in selling engines does not justify mass production as known in the United States, it cannot be denied that we ought to work in a more methodical way, as the trend of the times now demands.

Concerning the rational utilization of production facilities, we should be diligent and congenial, work, eliminate all unproductive tasks and obtain "frictionless co-operation" between office and shops. The influence of the latter is today surely the main concern of any factory. Germany can still learn many things from Americans.

I may not close this article without mentioning that in all the firms I have visited I have met with a reception which one could not imagine being more courteous. The manage-

ments of the plants were willing to show every detail of the work, with total absence of secrecy. It would stimulate the maintenance of agreeable relations with American industry to treat visitors from the United States kindly and appreciatively. I have heard repeatedly that the contrary has been experienced by Americans. It has been a great pleasure to me to find that German industry generally, and the M. A. N. especially, is enjoying high esteem.

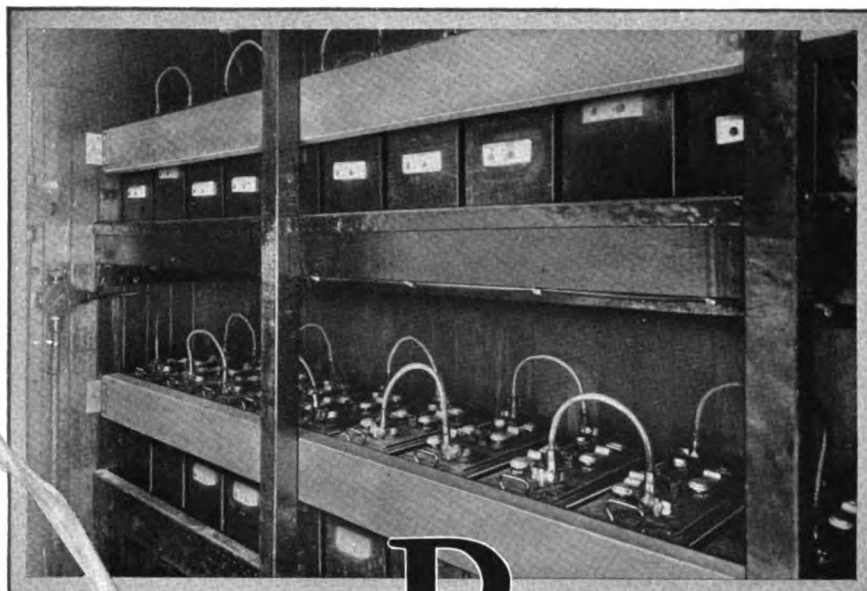
Comments on This Article

By J. Barraja-Frauenfelder

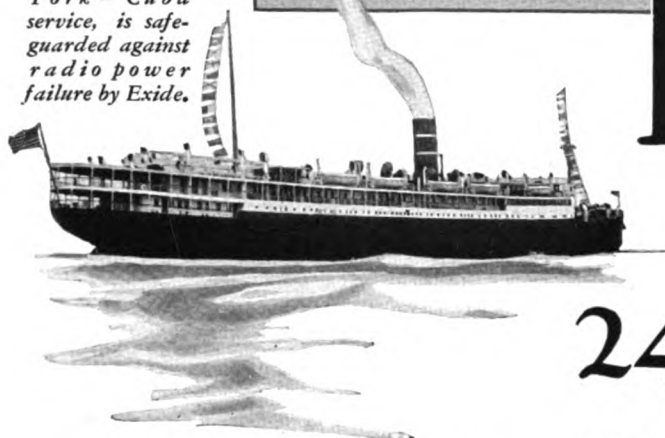
Doctor Lauster, to begin with, attributes the hesitation in the development of the diesel industry in the United States to the fact that this type of prime mover has proven to be too complicated for American operating conditions and in fact even too difficult for ordinary production. Nothing could be further from the facts. This hesitation, if it actually exists, is due to entirely different reasons. To assert that the diesel engine is too much for American ingenuity and resourcefulness is to deny at one stroke all the accomplishments, which by sheer use of these qualities, have been obtained in the automotive field, to mention one outstanding industry which is of a similar character as the diesel engine industry. The hesitation, if any, is due, first to the fact that it is a slow process, under no matter what conditions, to displace a firmly rooted industry devoted to the manufacture of one kind of prime movers, such as steam, with a newer industry which aims at supplanting the old order of things. If this process of displacement is stimulated by necessity then progress is faster, as evidenced by German and European achievements in this field. When a vital necessity does not seem to exist, as in the United States, then progress is slower. I have said that a vital necessity does not seem to exist in the United States advisedly; the necessity does exist, but it is not so fully in evidence as it is in Europe.

A second strong influence militating against the development of the diesel engine in this country is the apathy if not the antagonism of the public utility companies. It is a known fact that a public utility installation must be composed of very large steam units to be economical. This is not so with the diesel engine, as this type of engine is about equally efficient in small as well as large units. Practically the same fuel economy can be obtained with a 250 horsepower generating set as with a 10,000 horsepower set. The minute the public utilities accept the diesel engine, as

The S. S. Havana of the Ward Line, recently added to New York - Cuba service, is safeguarded against radio power failure by Exide.



The 60-cell Exide Battery that supplies power for emergency radio operation aboard the S. S. Havana



Batteries that stand 24-Hour Watches

Read how dependable emergency radio service is assured on the S. S. Havana

NO danger of sudden power failure crippling the radio on the S. S. Havana — Exide Batteries guard against that!

A powerful 60-cell Exide is on duty every minute, day and night—ready *instantly* to take over the vital task of radio communication. And in choosing Exide for this all-important work, the owners of the S. S. Havana chose wisely. They knew Exide could be depended upon in any emergency—depended upon to give power whenever it was needed.

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the finest on the Havana run. And when the S. S. Havana was recently added to the service, it was natural that Exide Batteries for emergency radio operation should be part of her equipment.

For every marine purpose

There is an Exide Battery for every marine use, on steamships or on motorships. Whether for emergency radio operation, emergency lighting, or operation of the steering gear; for operating winches in port, or for any other marine purpose — Exide Batteries always give the same long, dependable service.

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Exide

BATTERIES

FOR EVERY MARINE USE

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia
Exide Batteries of Canada, Limited, Toronto

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a standby, or even as a main unit, they will invite the small user of power to install his own generating set, as obviously he can produce energy just about as cheap as the public utility company with the latter's profit eliminated.

This field, including the public utilities and thousands of small power users, is very extensive and consequently would exert a powerful influence upon the development of the diesel engine industry, if thrown open to exploitation. This influence is naturally non-existent now. Compared with this field, the marine field is of relatively small though of increasing consequence.

Another obstacle in the path of legitimate development is the small army of would-be innovators. This comprises all the various discoverers of new cycles destined in their opinion to revolutionize oil engine design and to throw in the discard all that Doctor Diesel found by painstaking research to be the correct thing to do. In practically all cases the work of these innovators is only a duplication of the work that Doctor Diesel and other experimenters have done to prove the fallacy of the principles involved.

These ill-advised efforts which are based mainly on a popular American conception that every one is a potential inventor, naturally attract backers and consequently a large amount of capital. This capital when thus expended with no tangible results, leaves a trail of disappointment, skepticism, and resentfulness and has a very marked bearing upon the employment of capital along legitimate and scientific channels. Give the proper impetus by legitimate encouragement by all classes of power users, so that development along healthy lines could proceed systematically, the lack of so-called "manufacturing processes" would be easily overcome.

Regarding the statement that "after the diesel engine had been in use in the various countries of Europe, a half hearted start was again made for its introduction in the United States" I can only suggest that Doctor Lauster has failed to consult existing statistics. To make a half-hearted start again would imply that a stop had occurred and a gap formed in the progress of development. I cannot discover any such gap in delving through known data.

A perusal of the accompanying chart which shows the development of the diesel industry in the United States since its inception in 1892, with the exception of an experimental period from 1898 to 1902, discloses that the only lulls in the growth occurred in 1909 to 1911 (not an impetus as

Doctor Lauster implies) and in 1916 to 1917, which may be due to the war, and a small depression in 1921 due to the business slump of that year. On the whole the industry is shown growing very rapidly considering the handicaps under which it is laboring.

There are now more than fifty establishments making oil or diesel engines in the United States in some form or other and fully a dozen doing experimenting. Some are patterned after European designs, it is true, but an appreciable percentage are now genuine American designs and conceptions although the basic idea as evolved by Doctor Diesel still remains German.

What Doctor Lauster says about American preference for compressorless engines is undoubtedly true. The American inborn instinct to obtain results with the minimum expenditure of capital, material and energy stimulates such a course. But it is wrong to say, that such engines are for the most part modeled after European makes. If there is any branch in the diesel engine industry in the United States where more independence in conception from European influence exists, it is the compressorless branch. Foreign influence is more in evidence in the air injection types.

In the double acting two cycle field foreign influence is very marked, although developments of which Doctor Lauster is not aware, are going on completely independent from European ideas, while in the double acting four-cycle field such as the McIntosh & Seymour, we believe that foreign influence is not in evidence at all.

The Nordberg firm has never pursued its own design. A perusal of their published literature reveals the fact that until recently it has operated under Carel license, possibly becoming free from it in latter years, and subsequently acquiring a license from Fiat.

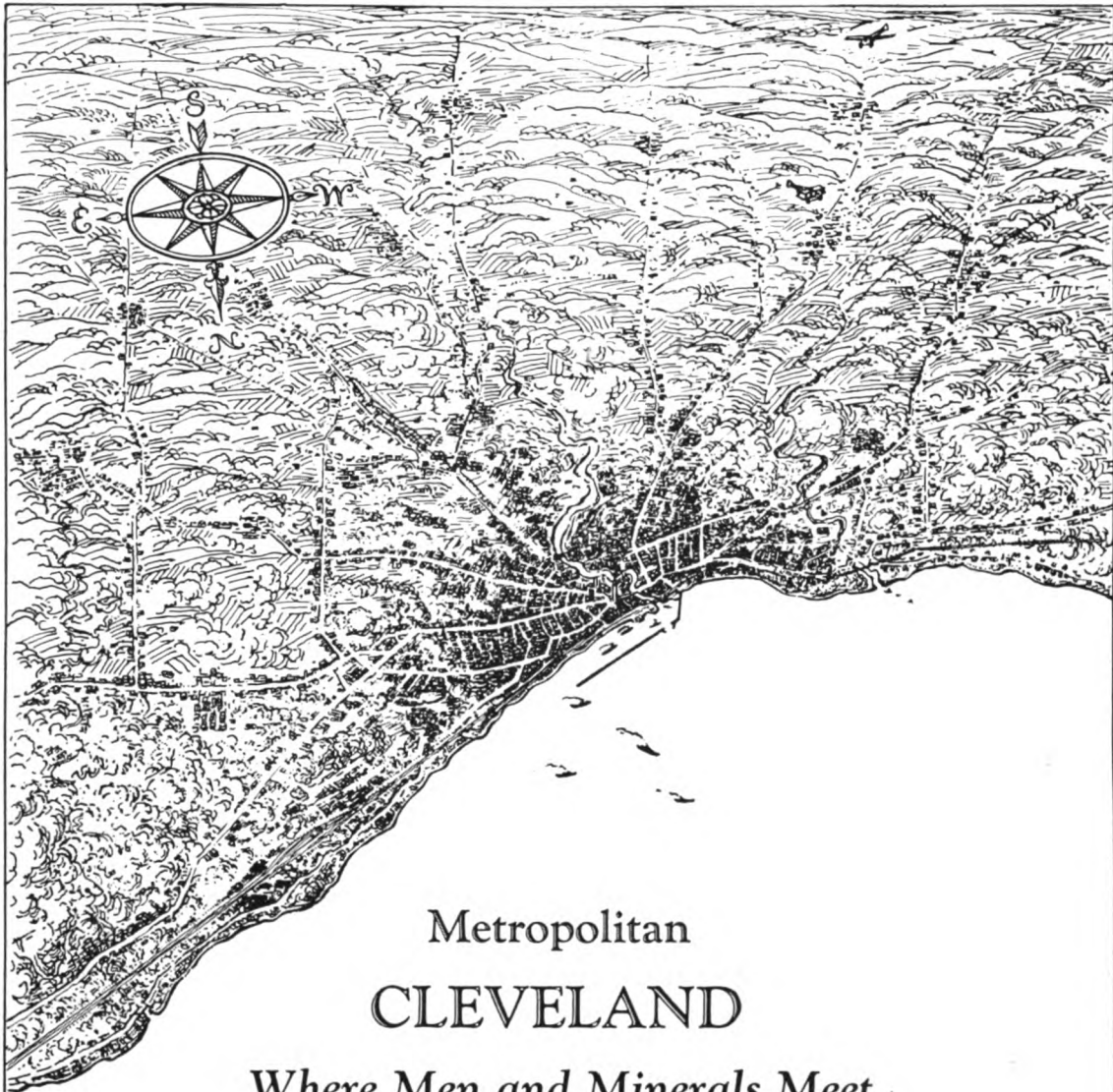
It is undoubtedly true that Americans have not thus far economized in weight. This is due to the well-known fact that materials here are cheap while workmanship is high. The reverse being true in Europe. European designers are often justified in adopting refinements in design to save materials. This is not necessary here, except that for ships a saving in weight is desirable from the naval architect's point of view. This tendency is now gradually disappearing and the newer designs show marked efforts in weight economy.

Doctor Lauster states that he did not notice mass production such as found in the Fairbanks-Morse works in units of several thousand horsepower; but

where in the world are units of such magnitude produced "en masse"? Not even in Germany! The engineers of every industrial country are yet too far apart in agreeing on standard types and designs to permit even reasonable manufacturing quantities. The diesel engine is still in a transitory stage and has not yet reached finality in conception to permit real standardization, and this applies to every country.

To say that the M. A. N. engine, "which in the course of time will be made suitable for American conditions, will play a large role in competition," is an ambitious program. Suitability for American conditions means simplification, drastic reduction in the number of hidden gas and water joints, and other matters. This will automatically throw it into conflict with existing American designs and patents. That the American built M. A. N. engine was the only engine in the United States which stood a 30 days' continuous test without trouble is true, but it was the New London built M. A. N. and not the one built at Hamilton that came through without stops, the latter had a stop of six hours and seven minutes according to official published reports. Other American built engines came through equally well, if the engines for the shipping board dieselization program are referred to. The Worthington engine stopped only 4 hours and 44 minutes for mishaps equally trivial to those of the Hamilton M. A. N., likewise the McIntosh & Seymour single acting stopped 5 hours and 48 minutes. The Busch Sulzer engine stopped 1 hour and 26 minutes, and the McIntosh & Seymour double acting 2 hours and 5 minutes.

In conclusion it is a little too sanguine for Doctor Lauster to state that America will have to utilize further and to a larger extent, German science and German spirit as a basis of her work, especially in research, and that she will need in the future *more than ever* the co-operation of European and especially of German firms, and the use of their experience. I do not doubt that we still have a lot to learn from European firms in this branch but not any more than what in the course of engineering evolution all nations learn from each other, and if there is any tendency in any particular direction in evidence at the present time, it is, first, that Italian design in the two cycle field is exerting a marked influence and showing a marked superiority in simplicity over the German, and second, that American engineers and designers are showing an increasing independence of foreign leadership.



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CENTER of one of the greatest raw products and manufacturing districts of the world; where coal meets ore and steel is made; where industries fabricate goods for the world's consumption, providing homes for more than a million persons; headquarters of and a portion of the district served by the

Central National Bank *of Cleveland*

AND HOME OF THE FOURTH FEDERAL RESERVE BANK

Lake Shipping Gain

(Continued from Page 77)

ments with ensuing great benefit to the country at large. The useful purpose of the Lake Carriers' association was forcefully displayed when the United States entered the World war. Dependent as the allied nations and the United States were upon steel and grain, the Lake Carriers' fleet was mobilized from within and throughout the crucial period of the war operated under the direction of the mobilization committee. So efficiently was the transportation of the lakes carried out without congestion or delays that this important arm served the country's aim without coming under government control.

Having in view the well-being of the men who man the ships, the Lake Carriers' association in 1909 instituted what is known as the welfare plan. The cardinal objects included the betterment of working conditions aboard ships, the improvement in the character of the men employed, the furnishing of opportunities by which they might themselves advance in seafaring life; the furnishing of club or assembly rooms for the use of the sailors at various ports on the Great Lakes. From every point of view the welfare plan has worked out well. With the opening of this year's season of navigation the Lake Carriers' association entered upon the twentieth year without there having arisen cause for a change in the fundamental principles covering the relations between employer and employee. Nineteen seasons of navigation have come and gone without operations having been disturbed by labor trouble. Notwithstanding that costs of vessel operation have not been lessened, that there has been a downward trend in freight rates on iron ore, coal and grain, the advances made in 1923 in the wage scale for all those in the lake service below the grade of licensed officers have been continued without change.

Betterment of Personnel

Principal features of the welfare plan which are assiduously promoted from year to year, include an original and somewhat unique method for the prevention of personal injury aboard ship; a savings plan by which the man aboard ship may bank all or any part of his earnings through the master and free technical schools by which the seaman may obtain an original license with resultant increased earning capacity and opportunity for still further advancement in the lake service. When the sav-

ings plan was introduced aboard the ships in 1911, total deposits for the season amounted to \$113,478. The annual growth of this institution has been so wholesome that total deposits for the season of 1927 amounted to \$1,750,969. The technical schools were established in 1916. During the 13 years, 501 oilers obtained their license to serve as assistant engineers, and 373 wheelmen obtained their license to serve as second mates. From the list of earlier students some have already been placed in command of a vessel as master and many are serving as chief engineer.

The Great Lakes fleet as at present constituted has the potential strength to carry out successfully any task of emergency that it may be called upon to fulfill. Striking illustration of its potentialities occurred in 1926 when it handled in the regular course of the trade and in addition to other commodities such as coal, grain and stone, a total of 48,445,434 gross tons of iron ore during the five months period beginning June 1 and ending October 31.

To Launch Virginia

The VIRGINIA, a sister ship of the CALIFORNIA of the International Mercantile Marine Co., the largest American built liner and the world's largest electrically driven commercial vessel, will be launched on Aug. 18, and take her place in the coast to coast service of the Panama Pacific line in December, sailing from New York on her maiden trip on the eighth of that month.

The main power plant of the new vessel consists of two marine type General Electric steam turbines directly connected to an alternating current generator. There are two driving motors, one directly connected with each propeller shaft. These motors are supplied with energy generated by the turbine generators.

Must Build Ships

The shipping board announced on June 22 that it was the sense of the board that mail contracts under the Jones-White shipping legislation should provide for new or improved vessels for the services, the first of such vessels to be entered on the service not later than three years after the signing of the mail contract.

The board feels that congress has unmistakably recorded its purpose in enacting the Jones-White act—that purpose is to build up a privately owned American merchant marine

comparable in quality with the merchant fleets of other nations. The bulk of the freighters now in operation under the United States flag do not meet those requirements, and therefore new construction is imperative or the purpose of the law will be defeated.

Thousand-Foot Liner

Reports indicate that actual construction on the new White Star liner OCEANIC started on June 19 at the shipyard of Harland & Wolff at Belfast. This is interesting in view of the fact that Lord Kysant, chairman of the board of directors of the line made the following reference to the projected big liner at the annual meeting held in London on May 16: "We have for some time past been giving our most serious consideration to the important question of the construction of the new express mail vessel so that we may continue to maintain the position and tradition of the White Star line in the North Atlantic trade."

It is said that the OCEANIC will be when she is completed in 1932, the largest vessel in the world. Her tonnage is to be 60,000 and her length 1000 feet. The new vessel it is estimated will cost \$30,000,000 so that it is evident that she will be finely equipped and exceptionally luxurious.

No definite decision is said to have been made as to the type of propulsive machinery. Though diesel engines are being given serious consideration, the recent marked improvement in efficiency possible with turbines using high pressure and super heat, and the use of turbine generating sets and electric motors for driving the propellers, make some authorities favor the steam drive.

Give High Efficiency

Interesting reports indicate that the new Canadian liner, DUCHESS OF BEDFORD built at a cost of £1,000,000 for the Liverpool-Montreal service is giving exceptionally good fuel economy. This vessel and her three sister ships are the first large passenger vessels using high pressure steam turbines and watertube boilers on the new system. The boilers are of the Yarrow type and the steam is supplied at a working pressure of 350 pounds and at a total temperature of about 700 degrees. The turbines are of the Parsons type and are connected to the propeller shafts by means of single reduction gearing. Weight, space and fuel economy are claimed for the machinery of these vessels.



Down To The Sea In Ships

This bank was seven years old in 1856 when the first cargo of iron ore came down the lakes and marked the beginning of modern lake traffic.

From that date on, men of the Great Lakes fleets — and salt water men too—have found safety for their savings here.

With more than \$95,000,000 in resources, with 79 years of experience, with special facilities for banking by mail, the Society for Savings is particularly qualified to serve the sailors.

“Banking-by-Mail” booklet gladly sent on request.

Incorporated 1849
Society for Savings
in the City of Cleveland
PUBLIC SQUARE

Put your savings in a savings bank

Revive Merchant Marine

(Continued from Page 87)

features including a part of the arguments of the radical free trader.

Notwithstanding all the agitation and earnest effort of many patriotic associations, nothing was accomplished and the subject was dropped until brought to the front as a result of the war and the formation of the shipping board to provide ships for wartime needs and the attempt to operate them successfully after the war in competition with foreign merchant marines. The true history of the shipping board's operations in these days of gigantic American national income and expenditure has been overlooked or is probably entirely unknown. Not taking into account interest on capital investment and depreciation the out-of-pocket loss from operation for the fiscal year ending July 1, 1927, was \$15,926,411.88, while several hundred ships built for war purposes have of necessity or because of the disinclination of the shipping board to sell them to foreign countries been allowed through the passing of time to become obsolete by present day standards. And now our congress has finally adopted a measure that provides:

1. Three-quarters of the cost of the construction rebuilding or remodeling of a ship may be borrowed from the United States government and at the lowest rate of any yield of any government obligation subsequent to April 6, 1917, and that the loan should be for no longer than 20 years and paid back in that length of time in equal annual instalments.

2. This construction loan fund has been increased to \$250,000,000 and should continue as a revolving fund until it revolves itself out of existence.

3. Included in this act is the important feature of the new ocean mail service which provides that American mail should be carried as far as possible only on American ships between United States and foreign ports.

4. The postmaster general is permitted to enter into a contract for ten year periods with American lines for that purpose.

5. The compensation for carrying mail on these ships is on a liberal scale and ranges from the rate of \$1.50 per nautical mile to \$12 per nautical mile and even above that in proportion to the increase in speed of the fast going ships.

There are other features of the act of unusual character having to do with insurance, employment of naval men, etc., but the foregoing represents the important features from which it is most clear that the United States is embarking upon a gigantic undertaking to give government support to the upbuilding of an American merchant marine owned

by the American people while in the meantime continuing direct government operation in strategic routes deemed necessary for the growth of commerce and the national welfare. The act is intended to encourage in every proper way all bonafide efforts by Americans to engage in maritime undertaking on private account.

If the money now available is handled as a banker would handle it, under the usual safeguards and precautions and is loaned without reference to political background and political influence, it will be a wonderfully constructive thing for the United States. But unless it is so handled the political features, the political contacts and the political influences are certain to eventually make its successful operation impossible. Unless this act is wisely administered and accomplishes the purpose intended, if the day ever comes when a complete audit shall be submitted to the American people of this whole operation from beginning to end and they shall realize what they have for all of this expenditure they will see a picture that will cause a violent reaction against the whole undertaking.

Marine Engineering

(Continued from Page 96)

tric engine room auxiliaries, and better heat balance arrangements including multiple stage feed heating. Some of the more recent steam turbine installations are operating with fuel economy costs very nearly equal to those of the diesel engines and entail less initial expense for machinery. The immediate trend is for still greater fuel economy by the use of steam having a total temperature of 700 degrees or thereabout. These improvements will result in increased activity of both geared turbine and turbine electric drive.

Auxiliaries, both engine room and hull, constitute an important factor in the overall economy of the ship. In the merchant marine, electric auxiliaries were first used extensively on motor ships. This was a logical step since the use of steam auxiliaries would necessitate a large boiler plant for which there would be no other use except in the case of heavy oil tankers. Hence, electric auxiliaries are relatively recent developments. The economics decidedly favor electric auxiliaries throughout, and in the case of a motor ship, their improved economy will pay the added investment in four years or less.

Aside from the extreme flexibility and convenience of electric auxiliaries

they effect a decided improvement in the economy. In the case of a steam ship the electrification of the engine room auxiliaries alone (using turbine generator sets) results in a saving of approximately 10 per cent of the total fuel used at sea. In the case of a cargo ship the electrification of the winches and other equipment reduces the port fuel consumption to approximately 35 per cent when using turbine driven auxiliary sets; and to from 10 to 5 per cent, and in some cases to less, when using diesel driven auxiliary sets. The additional initial cost of the electric auxiliaries is returned in a very few years by the economy which they effect in comparison with steam auxiliaries.

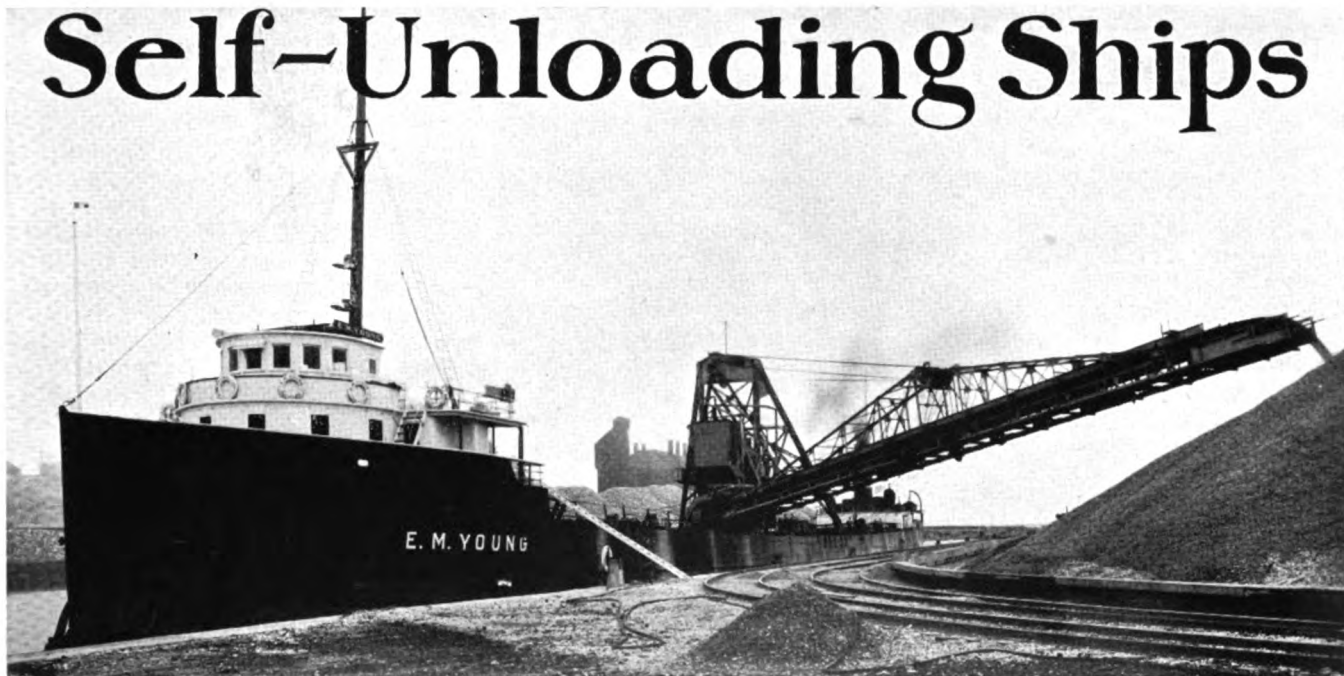
The modern ship, particularly the passenger and cargo types, are fast adopting electric auxiliaries throughout, including engine room auxiliaries, hull auxiliaries, deck auxiliaries, galley equipment, and state room heating. The merits, economy and reliability of electric auxiliary machinery, galley equipment, heating equipment and appliances for ship-board service are established and in the future the use of electricity for these applications will be the general practice, and the use of steam, the exception. Electricity will play a more important part in the future development.

We are now in a period of great advance in engineering and science to which the marine industry is contributing its share. The situation is highly competitive due to the many different types of propulsive plants and necessitates consideration of the problems on a purely economic basis. Fuel cost, carrying charges, general operating expenses, cargo earning capacity, reliability, trade route, relation of port to sea load, and many other factors are vital in the consideration of the problem. This is particularly important to the American merchant marine because of the relatively high cost of shipbuilding and the high cost of operation.

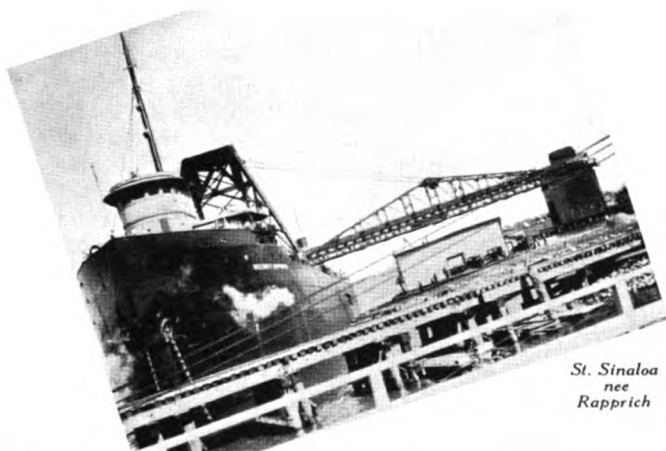
Low Fuel Oil Cost

It is understood that the shipping board through the Merchant Fleet Corp. has entered into a contract with the Standard and Gulf companies to supply fuel oil to government owned ships on the Atlantic coast for \$1 per barrel as against \$1.35, the former rate. Such a price will mean greatly reduced operating cost for government vessels since fuel for the average ship represents from 25 to 30 per cent of the total cost of operation.

Self-Unloading Ships



Str. Young nee Hoover & Mason



*St. Sinaloa
nee
Rapprich*



Str. J. E. Savage nee Thos. Brill

GIVE value to waterfront location of cities, industries, and other consumers of bulk materials.

By making deliveries in any quantities regardless of shore equipment.

Utilizing idle waterfront property for storage of materials.

Reducing cost of unloading materials and grief of maintaining dock equipment and dock labor.

Benefits the vessel

By reducing the port time which is usually a large percentage of the round trip cycle.

By increasing ships' revenue by the unloading charge.

By reducing wear on cargo floors and hatches from shore digging machinery.

Saves time waiting their turn at the unloading docks.

The Self-Unloading Ship has reached a high state of development on the Great Lakes.

The Coastwise Ocean trade and the Inland Waterways offer profitable fields of operation for vessels equipped with this apparatus.

To date twelve vessels have been equipped with the Leathem D. Smith Patented Unloader.

In addition four of these ships have sand dredging pumps for loading their own sand and gravel cargoes.

Now building twin screw Diesel engined propelled barge 240 x 40 x 16 equipped with self-unloading apparatus and dredging pump designed to operate in shallow draft and pass under overhead 16 feet bridge clearance.

Installations made at any shipyard

Leathem D. Smith Dock Co.
Plant at Sturgeon Bay, Wis.

Chicago Office: 205 W. Wacker Drive---Telephone State 1191

Men of Marine Affairs

(Continued from Page 92)

idea of a steam turbine coupled direct to the dynamo as a charging unit. This turbine which was the only rotary engine which proved practical from the first was finally produced shortly before 1889, during which year he severed his connections with Messrs. Clarke, Chapman & Co. In this same year, he founded the Heaton works at Newcastle-on-Tyne, concentrating his every resource and entire energy on the improvement of the turbine which was later to become one of the outstanding inventions of the century.

In 1897 the first notably successful application of the turbine to ship propulsion was demonstrated by the *Turbinia* during the British naval review at Spithead. Later, the two destroyers constructed during the latter part of 1899 and beginning of 1900 and engined by the Parsons Steam Turbine Co. Ltd., of Wallsend further attested to the superiority of the Parsons turbine by the attainment of speeds of approximately 35 knots.

Introduction of the Parsons turbine into warships was effected by the British admiralty and that department has continued to employ the type in a great percentage of the vessels constructed since its invention. Following the precedent established by Great Britain, the navies of all the important nations of the world have carried out programs of Parsons turbine installation. The *Tyrian*, built by Yarrow & Co. Ltd., of Glasgow, Scotland, launched in 1920, powered with a Parsons turbine, attained a speed of approximately 40 knots, greater than 45 miles per hour and faster than any vessel preceding it.

Sir Charles is a past president of both the Institute of Physics in Great Britain, and the British association, and past president of the North-East Coast Institution of Engineers and Shipbuilders.

Sir Alfred Yarrow

SIR ALFRED F. YARROW was born in London on Jan. 13, 1842. His education began at a small school near his home when he was six years old, continuing later under a private tutor and concluding at University College school, which he entered when 13 years of age and left when 15.

In 1857, the year which marked the close of his school days, he entered upon a 5-year apprenticeship course with Ravenhill & Co., marine engineers, in London. While there, the young apprentice went through the foundry, drawing office, turnery, and

pattern shop, absorbing the fundamental ground work of his career.

Two years after the founding of Yarrow & Co., in 1866, his first attempt of a purely marine nature resulted in the construction of a steam launch, the *ISIS*. This venture proved extremely successful and a total of 350 similar craft were built at the Yarrow plant. Turning to construction of larger vessels, Yarrow & Co., in 1875, built the smaller steamer *ILALA* and later the two gunboats *PIONEER* and *ADVENTURE*, all for service on Lake Nyassa.

At this time, Yarrow & Co. began concentrating on torpedo-boat con-



SIR ALFRED YARROW

struction, building the first vessel of this type in 1875 for the Argentine government. Between 1877 and 1879 orders for these boats were received from the governments of the principal nations of the world. These vessels, capable of a speed of 21.9 knots, established their designer's world-wide reputation. It was on one of these that the first Yarrow watertube boiler was installed.

Excellence of this type of boiler was established in 1892 by construction at the Yarrow yards of two destroyers, one equipped with the Yarrow watertube boiler and the other with the firetube. The *HORNET*, fitted with the Yarrow boiler, in competitive tests with the *HAVOC*, carrying a firetube boiler, consumed five per cent less fuel, weighed 11 tons less and attained a speed of 27.3 knots as compared with the *HAVOC*'s speed of 26.1 knots. Further proof of the superiority of the Yarrow boiler was added by construction of the destroyer *LURCHER*, *FIREDRAKE* and *OAK* for the admiralty. These ships were capable of great

speed, the *LURCHER* having attained a speed of 35.34 knots.

Beginning in 1890, while voyaging to the United States on the *MAJESTIC* and for many months subsequent to his return, Sir Alfred conducted exhaustive experiments on the subject of vibration resulting finally in the so-called "Yarrow-Schlick-Tweedy system" of engine counter-balancing, which eliminated practically all vibration.

The *SOKOL*, the first vessel in the world in whose construction high tensile strength steel was used, was built by Yarrow & Co., in 1895. In 1899 a large order consisting of eight destroyers and ten torpedo boats was received by the company from the Japanese government. Between 1914 and 1918 approximately 30 destroyers were built at the Yarrow yard.

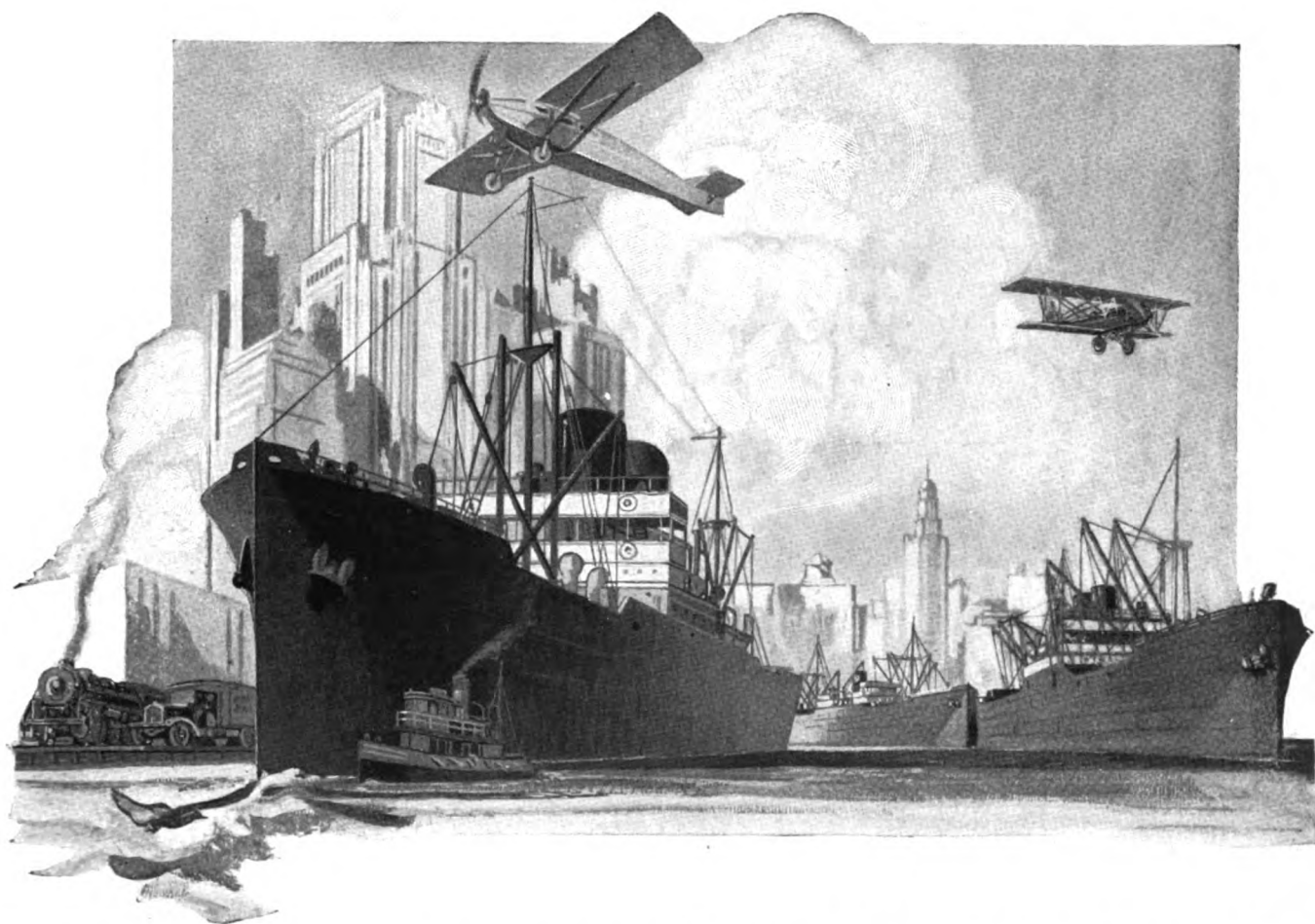
The world's fastest warship, the *TYRIAN*, was constructed by Yarrow & Co. Ltd., Glasgow, Scotland, and launched early in 1920. The *TYRIAN* in trials developed a speed of approximately 40 knots (over 45 miles per hour). She was fitted with the famous Yarrow watertube boiler and was the last of 29 destroyers built by the company since the beginning of the World war.

Rudolf Diesel

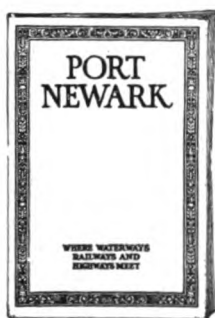
A STUDENT at the Munich Technical college a few years prior to 1880, became much impressed with the professor's description of the thermal inefficiency of the steam engine. This young scholar determined that one day he would invent a better engine, which he did, and thus we have the diesel engine.

Rudolf Diesel, the young man referred to was born in Paris during the year 1858. He received his elementary education in Paris schools until the war of 1870 led to the removal of the family to England where his studies continued. Leaving England he entered the Munich Technical college, graduating in 1879. He became assistant to the professor—von Linde, whose lecture was mentioned above—and later established an engineering practice in Paris. The confining nature of his profession did not obliterate his thought of that ideal engine and 13 years after his graduation saw the description of the still-theoretical power plant in condition suitable for publication.

Unlike the average type of inventor, Rudolf Diesel was a scientifically trained engineer, schooled in the principles and use of the graphs and formulas of mathematics. This perhaps accounts for the fact that the first public presentation of his engine met with incredulity and skepticism in all



Three Factors that are making PORT NEWARK a Shipping Center of the First Rank



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The Port of Newark has no time wasting lighterage situation to contend with. It is situated on the New Jersey mainland at the western end of New York Harbor, where five trunk line railroads from the West and South make direct rail-to-keel connections with twenty steamship lines offering regular service to principal coastwise and foreign ports.

It is within from three to twelve hours motor hauling distance of practically every important city along the Atlantic Seaboard—from Baltimore to Boston. It offers quickest access to a market of close to 43,000,000 people, the wealthiest third of the entire national market.

And now, with the operation of the Holland Vehicular Tunnel under the Hudson River, New York City itself can be reached by direct highway route from the Port of Newark in 20 minutes—permitting quicker deliveries of package freight to the metropolitan trading area from this point than from many parts of the New York or Brooklyn waterfront itself.

Have you been watching the steady increase in the volume of traffic which these outstanding advantages are bringing to the Port of Newark? If not, let us send you the facts—without obligation, of course.

Thos. L. Raymond, Mayor, Newark, N. J.

The PORT *of* NEWARK

“Where Railways, Waterways, Airways and Highways Meet”

MARINE REVIEW—July, 1928

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quarters except among those few professors and scientists who could see light through the maze of efficiency curves, graphs, formulas, etc., dispersed throughout his article.

Two powerful German firms, Messrs. Krupp and the Augsburg Nuremberg Co., came to the young inventor's financial assistance, and in 1893 the first diesel engine was built. According to his own statement at an address before the American Society of Mechanical Engineers in 1912 "it never ran at all." There was a terrific explosion which nearly killed him. This event gave him the information necessary—the knowledge that air can be compressed highly enough to ignite the fuel—and four years later in 1897 the first working diesel engine built by the Augsburg company attracted world-wide attention.

The fuel economy of the diesel engine is common knowledge. It has been said that a diesel engine will develop from tar—a by-product of coal—approximately four times as much power as a steam engine will generate from the original coal burned under its boiler. This illustrates the great saving in fuel in the use of the diesel engine.

Every maritime nation of the world is engaged applying the diesel-engine to ship propulsion. Slowly but surely this engine which grew out of that lecture in a classroom of the Munich college is finding increasing use afloat and ashore.

Rudolf Diesel did not live to realize the universal exploitation of his engine as a power plant. Following a lecture tour of the United States in 1912 and the early part of 1913 he was called to England for consultation regarding application of his engines for various uses. In crossing the channel on the return voyage he disappeared from the Antwerp-Harwich mail steamer Dresden, September, 1913.

Admiral D. W. Taylor

ADMIRAL DAVID W. TAYLOR'S life is a record of unusual attainments. Born on March 4, 1864 in Louisa county, Virginia, he received a portion of his early education at home and a part of it at Randolph-Macon college in Ashland, Va. In 1881 he was appointed a cadet engineer at the United States Naval academy, with the second highest rating of 130 candidates. Graduating in 1885 at the head of his class with the highest percentage rating made by anyone before or since, he was selected as special student for a course in naval architecture and marine engineering at the Royal

Naval college, Greenwich, Eng. and was graduated in 1888 with high honors.

Eminent success as a naval constructor was one of his accomplishments. In 1894 he was appointed principal assistant to Chief Constructor Hitchborn. During the time of his connection with the bureau of construction and repair he was in charge of the designs and building of the equipment apparatus for the United States Experimental Model basin authorized in 1897. After completion of this work in 1899, and until December 1914, he remained in charge of affairs at the Model basin. Within that period of 15 years his extensive



REAR ADMIRAL D. W. TAYLOR

research led to many improvements in naval and merchant vessel hull design.

In the United States and abroad, he is regarded as perhaps the foremost exponent of the science of naval architecture. Approximately every naval vessel constructed between 1900 and 1922 was from his design of ship lines. Outstanding among his contributions to notable improvement in destroyer design was his origination of the flush-deck type. Another marked advance in design detail materialized in 1905 with the building of the SOUTH CAROLINA and MICHIGAN. This departure—the centerline disposition of turrets—had been developed and urged by him ten years earlier, in 1895. It has since been adopted universally for the battleships of every nation in the world.

The collision of the Atlantic liner OLYMPIC and the English cruiser HAWKE off Cowes, England in 1911, resulted in lawsuit for which Ad-

miral Taylor was retained as chief expert witness for the admiralty. He was retained by counsel for the admiralty because of his high professional standing and the exhaustive research it so happened he had just completed at the Model basin on the subject of suction, or hydraulic interaction between passing vessels. As consequence of his convincing testimony the court rendered judgment regarding the case in favor of the admiralty. This decision has since been sustained in the highest tribunal of the English courts.

Two books, *Resistance of Ships and Screw Propulsion* published in 1894 followed by *Speed and Power of Ships* in 1910 established Admiral Taylor's status as an author of note. The last mentioned volume in particular has been recognized as the universal authority on the subject. Admiral Taylor was awarded the honorary degree of doctor of engineering by Stevens Institute of Technology in 1904. Other institutions bestowed honorary degrees, including that of doctor of science by George Washington university; doctor of laws, by Randolph-Macon college and doctor of laws, by the University of Glasgow, Scotland and doctor of engineering by the Naval college at Greenwich.

On Dec. 13, 1914 Admiral Taylor was appointed chief constructor and chief of the bureau of construction and repair in which position he continued until his own request in July 1922 to be transferred to the retired list of the navy.

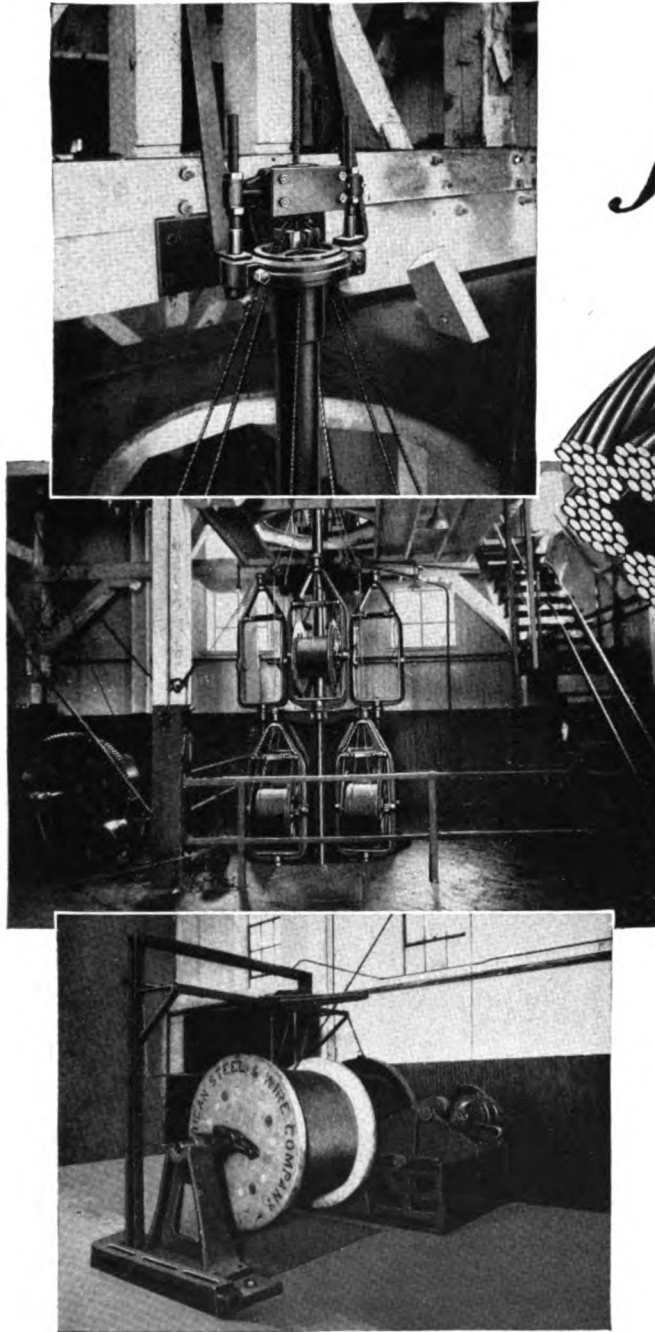
Admiral Taylor was elected president of the Society of Naval Architects and Marine Engineers in 1925, and retired after three years of service. In addition to this tribute of his profession, he was decorated by the French government with the order of commander of the Legion of Honor for "exceptional services in organizing the conduct of the war (naval construction)." The United States awarded him the Distinguished Service medal "for exceptionally meritorious service in a duty of great responsibility as chief of the bureau of construction and repair."

Elmer A. Sperry

ELMER A. SPERRY was born in Cortland, N. Y., Oct. 12, 1860, the son of Stephen Decatur and Mary Borst Sperry. His scholastic career began in the state normal school in Cortland and was concluded at Cornell university where he studied during 1879-1880. His most intensive training came, however, after leaving school, in intense application to those

American Steel and Wire Company

How Wire Rope Is Made



Wire rope is made by laying wires into strands and coiling the strands around a hemp or steel center which is saturated with a special lubricant. The rope laying machine illustrated is of the vertical type, that is, the bobbins are arranged to revolve in a horizontal plane about a vertical axis. As the coils rotate around the central core, they are drawn upward through a fixed closing die by means of a large draw-off drum. The rope passes around this drum several times before it is finally coiled upon a reel.

Rigid inspections follow each operation in the production of our wire rope. And all finished rope is tested and re-tested to insure uniformity of grade and construction.

Illustration 1 shows the strands passing through the fixed closing die. 2—The bobbins are mounted in frames which are maintained in one position to prevent axial twisting of the strands. 3—The finished rope is coiled upon a reel which is driven by the gearing of the machine.

MARLIN CLAD-HAWSERS-CARGO FALLS-RIGGING ROPE

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subjects which appealed to him.

In 1880, the Sperry Electric Co., manufacturers of arc lamps, dynamos and other electrical equipment, was founded by Mr. Sperry in Chicago. The Sperry Electric Co., Cleveland, which grew out of Mr. Sperry's designs of electric carriages and which was established by him in 1890, was sold in 1894 to the General Electric Co.

As the result of great inventive genius, the contributions of Mr. Sperry to the marine field and others have been of great and lasting value. The 400 patents which he holds in the United States and in Europe include the gyro-compass, stabilizers for airplanes and ships, a searchlight of the highest intensity known, gas engine and fire control apparatus and



ELMER A. SPERRY

numerous special devices, principally for the United States navy. In 1883 a beacon of 40,000 candlepower intensity and approximately 350 feet high—the highest in the world—was erected by Mr. Sperry on Lake Michigan. The first chain mining machine was produced by him in 1888, followed by his development of detinning and electrochemical processes which play an important role in industry.

Since 1910, he has been president of the Sperry Gyroscope Co., Brooklyn, which concern manufactures his inventions.

Mr. Sperry's innumerable inventions have resulted in making him the recipient of many national and international awards and prizes. In 1914, he was awarded the first prize of the Aero club of France and in the same year the Franklin medal in Philadelphia. At the San Francisco exposition in 1915 he received the grand

prize for the gyro-compass and gyro-scope. The year later he was awarded the Collier trophy for drift set and the *Scientific American* medal. He was decorated by the ex-Czar Nicholas of Russia for his great inventive contributions to naval equipment.

For a great many years, Mr. Sperry has been a member of the naval consulting board, chairman of the commission on aeronautics, mines and torpedoes and chairman of the commission on aids to navigation. He was a founder of the American Institute of Electrical Engineers as well as a founder of the American Electro-Chemical society. He holds membership in many scientific societies including the American Society of Mechanical Engineers, American Chemical society, Society of Naval Architects and Marine Engineers, Society of Automotive Engineers, National Aeronautic association, Franklin Institute and is an ex-president of the American Association for the Advancement of Science.

Mr. Sperry is a member of the Engineers club, the Aero Club of America, Marine and Field club, the Engineers Golf and Country club, and the St. Albans Golf and Country club.

Homer L. Ferguson

HOMER L. FERGUSON was born in Waynesville, N. C., March 6, 1873, the son of William Burder and Laura Adelaide Ferguson. Following graduation from the United States Naval academy in 1892 the scene of his studies was transferred to the Naval college at Greenwich, England where for three years, 1892-1895, his education and training in engineering continued.

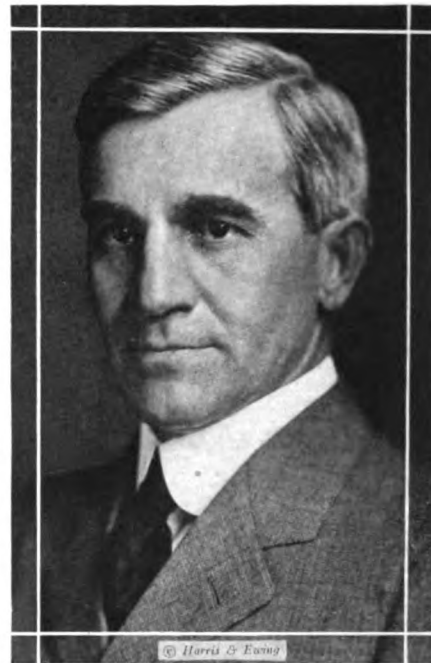
Having completed his scholastic career he was appointed assistant naval constructor and attached to the Columbian Iron Works at Baltimore in which position he remained from 1895 until 1896. From 1896 until 1899 he served as supervising naval constructor at the yard of Wolff & Zwicker, Portland, Oreg. The following year, 1899-1900 he served in a similar capacity in the navy yard at Bremerton, Wash.

Joins Newport News Shipyard

Continuing his career in the navy, he became superintending constructor at the Bath Iron Works, Bath, Me., remaining there from 1900 until 1902. From 1902 until 1904 he held the office of assistant superintending constructor at the Newport News Shipbuilding and Dry Dock Co., Newport News, Va. In 1904 he was called to Washington where he served at the bureau of construction and repair of

the navy department. Leaving Washington in 1905, he resigned from the navy and returned to the Newport News Shipbuilding and Dry Dock Co., as superintendent of hull construction and later general manager, until 1915, since which time he has been president as well as general manager of the company.

In 1923, when the reconditioning of the LEVIATHAN was carried out at the Newport News Shipbuilding & Dry Dock Co., Mr. Ferguson exercised all his skill as a shipbuilder and executive in completing this gigantic task. Successful consummation of the work was made possible through his broad experience and training. His personality is such that it encourages the most energetic and wholehearted



HOMER L. FERGUSON

co-operation on the part of co-workers.

Mr. Ferguson's services have not been confined to one field. A man of great executive ability, magnetic and masterful personality, he has been called into the organization of many affairs, both civic and national. He was president of the chamber of commerce of the United States during 1919 and 1920, has been a member of the National Foreign Trade council, of the advisory committee of the Massachusetts Institute of Technology, and the Academy of Political Science.

He is a member of the Society of Naval Engineers, and is now president of the Society of Naval Architects and Marine Engineers. He is a member of the Engineers club of New York, the Army and Navy club, the Washington City club and the Westmoreland club of Richmond, Va.